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COMPUTERWORLD

THE NEWSWEEKLY FOR THE COMPUTER COMMUNITY

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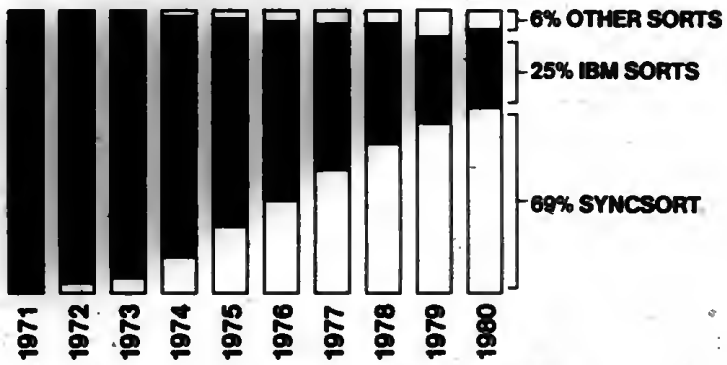

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PREDICTIONS THAT FAILED

Prediction is a fascinating business.

Turn a major page on a calendar, and it's like turning the crank on a jack-in-the-box — just as the melody really gets going, up pops a futurist, spouting uncontradictable wisdom about the era to come.

Now I haven't got anything against futurists. For one thing, looking into the future is a necessity. All of us want some clues about what's to come, in order to know better what to do with what's already happened. For another thing, futurists liven up the place. If we all spent our time waddling around in the present, where would we get grist for our fantasies? All of us, in fact, are closet futurists. It's just that some of us are not as good at it as others.

Which brings me to the point of this article. There's a sadistic side of me that says, "In this time of forecast '81, let's check out the accuracy of the futurists of the past." Are futurists, in fact, generally worth listening to? It's a rotten question to ask, of course, in an article placed at the front of a suite of articles by futurists. But then, it's also an honest, useful question to ask. Let's.

Tip-toe with me, if you will, into the library stacks of the past. Sh!

Let's not tell our surrounding futurists what we're up to. Quietly, quietly, let's move swiftly over to the dusty computing periodicals of yesteryear. Here, among the pages ripe with pony-tailed young sex symbols selling computing products to crew-cut executives, are the futurists of the past. What are they saying?

Here's one in the January 1970 issue of *Datamation*. Lowell D. Amdahl is answering the architectural questions of the '70s in an article by the same name. "The third-generation infant has toddled, walked and now runs . . . Can another generation be far behind?" The answer, implicit in all that follows, is a resounding "No," Amdahl said.

Well, here we are 10 years later. The third generation infant is still running, and it looks a little different, what with all its facelifts. But basically, it's still the same child-now-grown-older.

"But," you whisper quietly so as not to disturb our library stack neighbors or alert any listening futurists, "maybe that was just one futurist's view. Surely others knew that the calamity of the generation change was nearly wound down?"

Ah-ha, here's another in the same magazine. Philip A. Dorn, in an article entitled "The Onslaught of the Next Generation," is saying, "Let's predict the next generation will be along soon, that it will be incompatible, that the users will snap it up, that the errors of 1965 will be repeated and magnified, and that you read it here first." Matters get worse, not better. Now the futurists are fighting to be first in line to be wrong! At least on major issues like new computing generations, the futurists were as good as out to lunch.

"Well, then, what about distributed processing as seen from the past?" you

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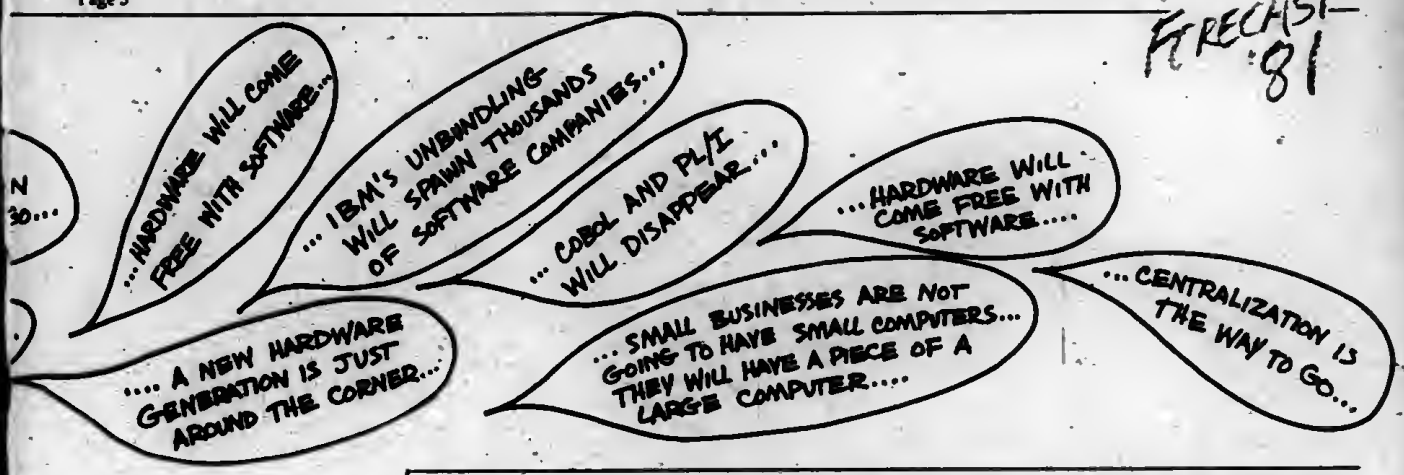
Glass, a 25-year computing veteran, is the author of several books and a regular CW contributor.

FORECAST—'81



By Robert L. Glass

ask, in hushed tones. "Surely the futurists saw that one coming." A good question. Let's check it out.

Here, in this same library-stale-smelling periodical, Lowell Amdahl has an answer. "All things considered, there would seem to be a developing tendency toward centralization for the large corporate user," he said. A little evasive, you say, what with all that "seem to be" and "larger corporate user"? Well, what about this one: When it comes to general-purpose computing, the economies of scale are swinging increasingly in the direction of large machines." Martin B. Solomon Jr. expressed that view in an article entitled "Are Small Free-Standing Computers *Really* Here to Stay?" in the July 1966 issue of *Datamation*.

That one's fairly clear — these futurists have come down firmly on the wrong side of the distributed processing fence.

Moving right along the stacks, let's look at software issues. It's 1970 again, and we're just beginning to recover from third-generation computers and software "unbundling." Remember unbundling? In the early days of computing, all software came "free" with the hardware. ("Free" is in quotes because it was often true that the more expensive hardware just happened to have more software with it than the cheaper hardware.)

Then, late in the 1960s, some of the hardware companies came to the far-sighted conclusion that software cost too much to give away, and they began charging for it separately, unbundling the cost out of the total hardware price. It was about this time that software entrepreneurs began salivating heavily, fantasizing the potential profits right around the unbundled corner. In the midst of this anticipation, a futurist of the '70s predicted

(Continued on Page 6)

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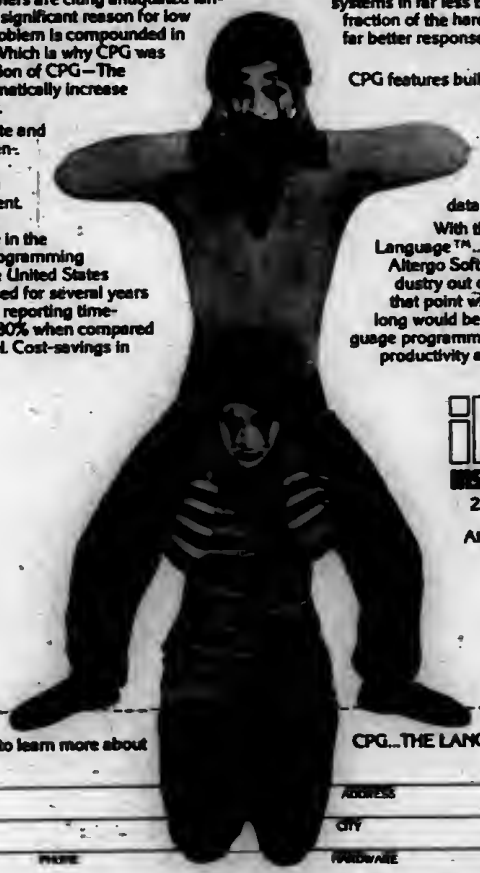

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(Continued from Page 5)

"the practice of separation between hardware and software sales may soon see as many as 1,000 companies, each offering scores of software packages for sale." That futurist was Howard Bromberg, also writing in the January 1970 issue of *Datamation*. The article was titled "Revolution 1970."

Alas, like the other forecasters, Bromberg saw all too clearly through a clouded crystal ball. The hardware companies, who could read futurist predictions as well as the next computing person, set their software prices carefully — just high enough to make some money, but just low enough to discourage predator companies — and the software entrepreneurial boom bombed. Not totally, of course. There are many successful software houses today. But not by the hundreds, each offering scores of products.

Then let's try over here . . . Look! It's a veritable treasure trove of past futurism. It's a series of 1970s-era interviews with "decision makers" published in *Computer Decisions* magazine. Each of the interviewees seems to be grinding his own ax, making a prediction that matches what he wishes would happen. Now this is a whole new kind of futurist, the kind who believes that predicting can make it so.

What did these attempts at self-fulfilling prophecy predict? Try these on for size:

• On small computers: Willian Bennett, in the January 1970 issue of *Computer Decisions* magazine, said, "Small businesses are not going to have small computers. It's not a practical way to go. Small companies are going to use a piece of a large computer."

• On the people problem: "As the industry matures and the pool of competent, experienced people expands . . . employers will have more candidates to choose from and then the marginal professionals . . . will have fewer opportunities." That bit of rare insight was expressed by Myron E. Parr and appeared in the March 1970 issue of *Computer Decisions*.

• On programming languages: "I believe that a major change to come on the part of users will be a shift away from both Cobol and PL/I . . . The computer world keeps talking about Cobol as if they knew what they were talking about. But in the final analysis, it just won't work . . . Cobol is hopeless." Peter Harris expressed those views on the subject in the March 1970 issue.

• On service bureaus: Chester Young, in the same series, was quoted as saying, "Service bureaus are in for some major changes . . . The most profound change will be a potential abandonment of "dedicated" in-house facilities by many companies."

Talk about out to lunch! These futurists missed the boat on such items as the microcomputer revolution, the ever-worsening programmer shortage, the ubiquitousness of Cobol (it's still number 1 on the programmers-who-use-it hit parade) and the role of the in-house computer. That's a pretty good grand slam of failed futurism!

Perhaps it's unfair to focus on predictions made in popular trade journals. Have the serious, scientific publications had something more accurate to say?

Over here, on this other set of shelves, are some prestigious journals. For openers, there just aren't any blatant predictions here. Look at this end-of-the-decade 1960 issue. There's stuff on sorting and character sets, but nothing on what the sorts or sets of the late '60s might look like.

1970s-Era Forecasts

For balance, let's look at the '70s. If the popular journals were looking forward to fourth-generation hardware, centralized computers and software package proliferation, what are the serious journals saying?

Here's a computer science article on management information systems (MIS). Ah, the MIStique of the beginnings of the MIS era. What a shame it turned out to be, in many respects, a MIStake. We didn't know as much as we thought we knew, we can now see, about the information needs and methodologies of running an organization. The promise of the '70s dissolved into the partially successful groping of the '80s.

Were the predictions of the serious scientists of the '60s any better? Let's move down the stacks a decade, a few inches of printed matter, and take a look at some older computer science articles. Ah, here's one on theorem proving. We'll be using computers to evaluate and derive proofs for tough mathematical or philosophical questions in no time at all — that's the promise of the article. It was a promise to be left unfulfilled.

Maybe the problem here is that we're not listening to the real experts — the ones who are computing's household names. Let's do a quick scan for some quotes by some names of note. Ah,

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FORECAST '81

here's Dan McCracken, well-known author and professional society activist. It's about a decade ago, and he's saying that Cobol will no longer be in use by 1980.

And over here, in a tattered issue of *Computerworld* dated June 7, 1972, Herb Grosch, another society activist and professional doubting Thomas, is predicting that by 1980 IBM will be the only computing supplier!

And even IBM itself isn't a very good seer. When IBM was bringing out the 7090, its top management felt that that super-fast new device would saturate the market with sales of 30 systems.

Well, with Cobol still the Number 1 language, with IBM competitors flourishing and with a computer in every garage (philosophically speaking) perhaps the real experts are no better than the unreal.

What to Do?

So, if the popular journals aren't very reliable at predicting the future and neither are the serious journals, or the well-known names, then what's a computer person who cares about the future to do?

One obnoxious answer is to go ahead and read all the predictions in this issue of *Computerworld*; add a healthy measure of doubt and file them away on a shelf to be looked at later — much as we just finished doing.

But there's another answer. It's the cowardly approach to predicting the future. What follows is a set of predictions made purely for the sake of boosting the predictor's average. They may not create a lot of fantasies — the other futurists on these pages will be much more fun — but they are backed by the knowledge of the solid, dull past. So here they are: the frustrated, failed futurist takes a nonrisk, nonmyopic look into the highly visible future:

- People will continue to make predictions about next-generation computers. Technical journals will continue to carry increasingly-more-accurate foresight on hardware-to-come. And, someday, those predictions will come true.
- Computer hardware builders will continue to be congratulated on the breathtaking drop in the purchase/-lease price of their products. People will continue to predict that hardware will soon be given away free with software, a rebundling 10 years after unbundling.
- Hardware improvements for the software builder will be nearly nonexistent. There will be no dramatic improvements in instruction sets or register conventions. The "Fortran machines" and "Cobol machines" of the year ahead will be the same sales-puffed paper tigers they were 10 years ago.
- People will continue to predict that automated generation of software by powerful utility programs is just around the corner. They will continue to be wrong, just as were their very bright colleagues of 10 years ago and 20 years ago.
- Software solutions for distributed systems will continue to be elusive. It is one problem to tie several hardware boxes onto bus connectors and say that the computers are now talking to each other; it is another to write the software that truly makes them talk.
- Some academicians will continue to base both theory and practice on the belief that programs may be proven correct someday. Some industry specialists will ignore proof of correctness on the grounds that it is too hard, too costly and too dubious. Time will prove the correctness of the industry approach.
- Managers of software projects will insist on more and more English-readable documentation describing their programs. Software specialists will grit their teeth and produce that documentation, knowing that no one but them will ever know if it really matches the code.
- Lecturers will get very rich presenting seminars on the new Defense Department programming language Ada. Theoreticians will both laud and ridicule that complex language. Pragmatisms will move fearfully toward the major new learning experience. Fortran and Cobol will, once again, survive.
- The adjective "structured" will continue to be applied to every meaningful noun in the computing milieu. It will continue to mean whatever the author of the moment says it means. Lecturers will not get as rich presenting seminars on structured methodology as they did five years ago.

Oh, and one last prediction, one with which no one will disagree:

- Next year at this time the futurists will pop out of their jack-in-the-boxes again with a whole new set of predictions. And we will read them just as avidly as we did this year's!

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By Vincent C. Rauzino

THE LOOMING BATTLE BETWEEN DATA BASE MACHINES AND SOFTWARE DATA BASE MANAGEMENT SYSTEMS

The rapid-fire effects of accelerating computer technologies have barely given user consciousness time to absorb data base management systems (DBMS). That same, much-battered consciousness is now being asked to absorb a potentially orders-of-magnitude improvement in DBMS called data base machines.

Obviously, the pace of technological innovation is not going to diminish during the coming decade. If anything, it will become even more furious and, consequently, less comprehensible to the user. However, the user cannot afford the option of ignorance, so each innovation must somehow be examined and incorporated into plans for growth.

The purpose of this article is to help the reader assimilate the important new technology of data base machines now and to project its impact on future computer installations. Data base machines will contribute just one brush stroke to the computer canvas of the '80s, but that single stroke could help add the long promised color of "information" to the drab browns and grays of data processing.

A data base, quite literally, is any collection of reasonably coherent data. Coherent data implies a systematic organization so that information can be retrieved by anyone who knows the system. A paper-based office file stored in metal cabinets qualifies as a data base. We could even bring the definition down to include, say, a collection of canceled checks, provided the checks are stored in numerical (thus coherent) sequence.

However, "data base" takes on a special meaning when it is linked with "computer." It can still be as conceptually simple as a canceled check file, or, more to the issue at hand, it can be a truly glorious collection of coherent files, compilers and interpreters, indexes, languages, communications interfaces, auditors and elaborate security safeguards.

This vast multipart structure is more aptly called a data base management system, with heavy stress on "management" and diminished emphasis on "data base." (DBMS is really what is meant by the data base part of a data base machine, but data base machine is euphonically superior to data base management system machine.)

Machine is easier to define. It is simply a generic synonym for computer metal that figuratively connects the heady world of DBMS software to the seemingly more functional familiarity of hardware.

A data base machine, then, is a computer or computer-like device whose sole purpose is to execute DBMS software or firmware relative to a coherent data file. A data base machine is not intended to be an independent computer, although it can be. It reacts to, and is controlled by, a general-purpose host computer. It also requires a disk subsystem to store the related data file.

It thus sits physically and logically between a general-purpose computer and at least part of the disk subsystem that forms a complete processing installation.

It is probably premature to talk about data base machines in the present tense because only a few products have been formally announced, and none as yet have been formally delivered. The most interesting device currently announced will be available only to OEMs. Because this article is framed in the future tense, we will arbitrarily treat data base machines as a current market commodity.

There appear to be two general ways to implement a data base machine: extracted function and dedicated function.

An extracted-function data base machine is defined as a standard DBMS, such as Cincom Systems, Inc.'s Total or Software AG's Adabas, that is off-loaded into a general-purpose mini- or microcomputer. A dedicated-function data base machine is defined as a special piece of hardware specifically optimized to handle the functions of data base and disk management.

An example of an extracted-function data base machine (EF/DM) is Software AG's recently announced Adabas data base machine, which is marketed as a "back-end data base machine." The "machine" part is provided by a dedicated mini of unspecified ilk and vintage called the externally supported processor or, predictably, the ESP.

ESP is compatible with the IBM 360, 370 and 4300 and can even run DOS, OS and VM/370 operating systems to back up its hosts in a crisis. An ESP can support 1M to its host through a channel-to-channel communicating system (CTCS).

CTCS consists of a data base machine communications module (DMCM), which resides in the ESP, and a user machine communications module (UMCM), which resides in the host; both help optimize the channel transfer rate.

Most of the Adabas nucleus is off-loaded to the ESP, where all updates, deletions, additions and disk management operations are handled independent of the host. Applications programs executing in the hosts call needed portions of Adabas through the CTCS interface. The programs are, in turn, translated and sent to the ESP for data base-related processing. One host can support multiple Adabas machines, and one Adabas machine can support multiple hosts.

Software AG claims that 60% to 70% of Adabas CPU time can be off-loaded from the host; tests conducted by the company have reportedly demonstrated a 25% average increase in throughput for an off-loaded Adabas vs. a host-resident Adabas running the same jobs. The purchase price of the Adabas data base machine is approximately $400,000.

An example of a dedicated-function data base machine (DF/DM) is a device an-

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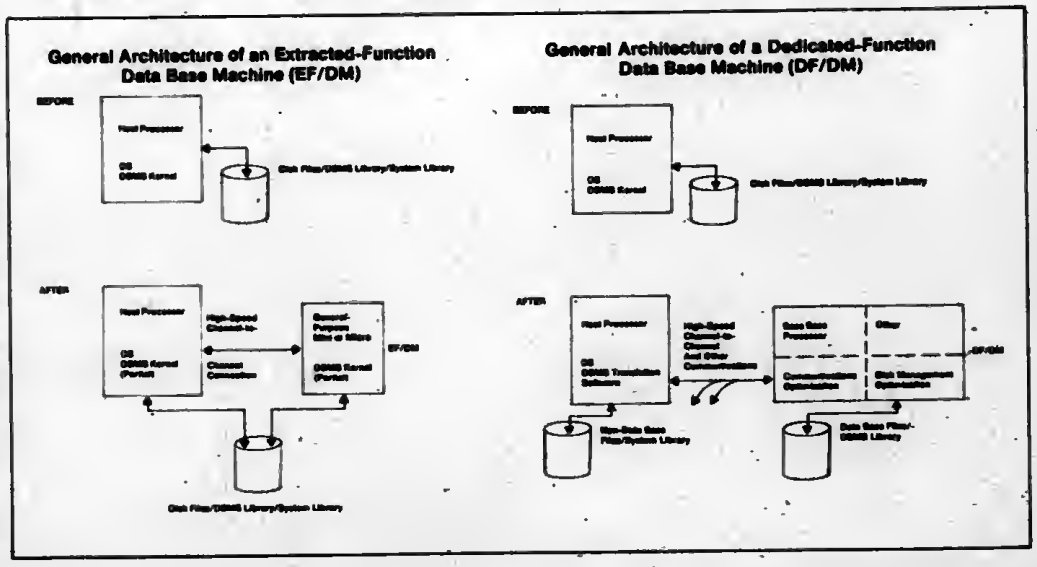

Rauzino is senior editor/analyst of Data Decisions, Inc. in Cherry Hill, N.J.

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nounced by Britton-Lee, Inc. of Los Gatos, Calif., and scheduled for delivery in December 1980. It is called the Intelligent Database Machine (IDM) 500 and is offered only to OEMs. The data base and machine components of the IDM 500 are both highly innovative and incorporate many state-of-the-art data base techniques that thus far have only been talked about in the journals and at conferences.

The IDM 500 DBMS is one of the earliest commercially available completely relational data bases. It supports a file structure of relations (tables) in third-normal form (no repeating groups and no full or transitional dependencies). Logical views into the relational files are supported by B-trees (balanced-index hierarchies) and an integrated dictionary.

It is manipulated through a single language interface that includes all the functions of a data description language, a data manipulating language and a query language. Up to 32,000 relations can be handled within a maximum disk volume of 32G bytes. The maximum size of a relation is 2 billion 2,000-byte tuples (rows) and 250 domains (columns).

The IDM intelligent data base language (IDL) is a derivative of Quel, developed at the University of California, and of SQL2, developed by IBM for its fabled "System R." SQL2 is also the language used with Oracle, which is the first commercially available fully relational DBMS software package.

The machine portion of the IDM 500 is variously configurable. The minimum configuration consists of a specially designed data base processor with 256K bytes of random-access memory (RAM); one special asynchronous I/O channel that can handle up to eight terminals at speeds up to 19.2K bit/sec or one byte-parallel channel that operates at a rate of up to 250K bit/sec; and one 4-drive disk controller.

The maximum configuration supports up to 3M bytes (12 256K-byte boards) of RAM, up to eight mix-or-match serial/parallel I/O channels and up to four 4-drive disk controllers — and a most interesting option, a 10 million instruction per second (Mips) auxiliary Schottky transistor-to-transistor (TTL) pipelined processor called a data base accelerator. Britton-Lee claims a standard rate of 2- to 5 transaction/sec and an impressive 20- to 25 transaction/sec with the data base accelerator in place.

To round out the general picture of the IDM 500, it supports one clustering index per relation, up to 255 nonclustering indexes per relations and up to 15 domains (keys) per index. One IDM can handle up to 50 separately defined data bases within the maximally defined disk volume, and the IDM 500 was designed for multithread operation.

The minimum IDM 500 configuration sells to OEMs for $50,000 each or $27,000 in quantities of 128 or more. A fully configured IDM 500 can cost more than $150,000, with a variable option-dependent discount schedule for quantity purchases.

The preceding two examples of currently marketed data base machines are representative of the EF/DM and DF/DM models postulated earlier as the two mainstreams of data base machine architecture. But they are certainly not definitive examples of their respective genres, nor are they necessarily the only possible architectures for data base machines. They are aimed at approximately the mid-range of computer users and, thus, do not directly address the problems of users at each end of the processing spectrum.

However, certain constants appear to exist in a sufficiently large segment of the processing domain to warrant some generalizations on the criteria of the "ideal" data base machine. These criteria will be discussed in the following and will then be compared with the Adabas and IDM models to assess the actual fit of each model to the theoretical ideal.

Relationship to Host Operating System: DBMS programs, even the smaller ones, are inevitably in regular conflict with the host operating system, usually to the detriment of the optimum execution of the DBMS. Two obvious illustrations are the running DBMS/OS battles over virtual storage space and the physical placement of data on disk storage.

The conflicts result from the goal of an OS to share system resources among as many users as possible vs. the goal of a DBMS to linearize system data into modules that can be conveniently accessed by programs known to the data base.

The resulting tug of war is between the forces of generalization and specialization, which is the underlying motivation behind the entire idea of data base machines. The ideal condition is to disentangle the DBMS as completely as possible from the host

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OS and, further, to make it independent of any specific operating system.

Language Interface: Obviously, a DBMS cannot be completely excised from its host OS, but the extent of its connections to the host depends almost entirely on the nature of the command/response interface between the DBMS and the host OS.

The ideal interface is a relatively nonprocedural language that uses the host operating system as a simple translation conduit to the interpretive and compilation facilities of the DBMS.

Similarly, the response from the DBMS should be as close as possible to the requested result. The operating system should not have to deal with raw data from the data base.

Architecture and Function Optimization: The picture that emerges from the preceding two criteria is of a freestanding DBMS, complete with independent disk management, indexing, data dictionary, compiler/interpreter, logging/auditing and security facilities, all with very generalized software linkages back to the host and, ultimately, to the user.

Each portion of this freestanding model can now be selectively optimized to enhance the performance of the DBMS without worrying about the effects of the optimizations on the host operating systems. Some optimizations that suggest themselves follow:

(1) Design data base-specific processor to get rid of the unnecessary components of a general-purpose computer.

(2) Include self-contained RAM for the DBMS kernel and a buffer (cache) for the disk and the host.

(3). Translate all standard software (e.g., disk management) into microcode and augment the code execution through embedded microprocessors.

(4). Maintain independent and autonomous control over an assigned disk volume to implement best-case data distributing and accessing algorithms.

• **Communications:** The two major impediments to the development of data base machines have been the lack of effective nonprocedural languages to support the DBMS excision from the host OS and the relatively slow speeds of the disks and the data channels that connect the disks to the processing environment. Remote communications still present a difficult speed problem, but higher disk transfer and local communications rates, particularly channel-to-channel rates, now more than offset the cost of managing the communications.

The ideal data base machine should thus have a communications interface that matches and preferably exceeds the highest current channel transfer rates. Teleprocessing (TP) functions can still be deferred to the host's monitor, but independent TP control could certainly be a component of future distributed data base machines.

Adabas vs. IDM 500 Machines

According to the preceding criteria, the Adabas machine, which exemplifies the EF/DM approach, does not qualify as a data base machine.

Although Adabas now includes an optional query-type nonprocedural language called Natural, most programming interaction with Adabas still occurs through its three lower level standard procedural languages. The inverted-file nature of Adabas with its heavily indexed logical structure also requires an inordinate amount of attention from its host OS. Adabas is typically tailored to its host OS to optimize the OS interface and is thus moved farther away from the independent ideal.

The Adabas data base machine is basically a general-purpose mini, which immediately violates the spirit of Criterion 3, and very little of the Adabas software is optimized in the equivalent of microcode to internally accelerate any Adabas functions. The Adabas machine is, however, supplied with channel-to-channel communications enhancements to satisfy part of Criterion 4.

The net result is that part of the existing Adabas software is simply transferred from the host into an associated mini that can then execute certain Adabas programs concurrently rather than serially within the host OS context. In other words, Adabas is treated as a semiperipheral connected to a high-speed direct memory access (DMA) port, with part of the I/O control system resident in the peripheral.

The IDM 500 qualifies as a data base machine, but with certain distinct limitations.

The choice of a relational structure for the IDM 500 data files not only supports but actually encourages independence from the host because of the inherent simplicity of relational language command predicates. The IDM 500 data base processor is not a general-purpose device, but is de-

(Continued on Page 12)

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signed specifically to handle only DBMS-type operations. The criterion for function optimization is amply satisfied by the optional 10 Mips data base accelerator. The internal buffer (cache) is designed as a flexible two-way bucket for host-disk transfers, and the communications ports are at least plentiful if not overwhelmingly fast.

The significant point of the IDM 500 is that the design is totally new, so that the intelligence in the system could be broken into pieces during the design phase and positioned for best leverage within the system. Thus, the burdensome task of disk management, such as retrieve, update and write, for example, is separated from the processing software to gain another level of concurrency with consequently better throughput efficiency.

The reader could at this point safely surmise that the DF/DM model in the IDM 500 mold gets our total vote of confidence for the data base machine of the '80s, and that reader would be correct as long as the entire decade is considered. Unfortunately for Britton-Lee and for others whom we are sure will soon follow, there are a few current and insistent problems that dampen our short-term enthusiasm for DF/DM devices.

OEM Service

The IDM 500 is sold as an OEM device because its beautifully independent qualities also make it impossible to talk to directly from any given operating system. Someone must tailor a machine-specific software interface to the IDM 500. This is an unfortunate gap, but it also represents an interesting opportunity for a whole new group of cottage-industry software houses.

A relational data base is probably the best, and perhaps the only, choice for a DF/DM device, but a relational file must be normalized before it can work. The normalization process is an arduous, wholly intellectual effort that must be done off-line by people. Very little machine help is currently available.

On the other hand, Adabas, Model 204 and a few of the other DBMS' accept relatively unstructured files that can be loaded onto disk in a few hours with very little massaging.

The trade-off is simple. A relational file, once normalized, is exceptionally easy to maintain under any circumstances though it may have required considerable manpower to normalize. An inverted file, such as Adabas, can become very difficult to maintain, particularly in a large, volatile environment, though it was probably extremely easy to load initially.

The normalization or file conversion problem will probably also effectively lock out DF/DM systems from existing data base users, particularly if Total, IDMS and the other established DBMS' are offered in EF/DM form in the manner of Adabas. Very few users will be willing to tamper with working files simply to gain a place in tomorrow's sun.

More likely, they will opt for an EF/-DM version of their existing DBMS, and we fully anticipate that the established vendors will offer liberal software-to-hardware trade-ins to discourage experimentation among their users.

The short-term future, to about 1983, for true data base machines, or DF/-DMs as we have defined them, will probably be muted for the reasons we have just discussed, but established vendors will not be able to maintain their holding pattern forever. They will have to compete very hard with the upcoming DF/DM vendors for each new data base installation.

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By Rita Shoor

RELATIONAL DATA BASE MANAGEMENT SYSTEMS: FACT AND FICTION

"Relational data base management system (DBMS)" joined "structured methodology," "programmer productivity" and "distributed processing" this year at the top of the information systems buzzword honor roll. And, you can expect to hear more about relational systems for the next few years. But what is the current form of the relational DBMS — if it truly exists — and what changes might be expected in the near future?

First, it might help to pin down what is meant by "relation." As is often the case with DP-related jargon, this is more easily requested than accomplished. A few years ago, no one had heard of the term, noted Ron Weeks, a product manager with Cincom Systems, Inc. "Now, you ask nine people [for a definition] and get 10 answers."

When in doubt, it is perhaps best to go to a recognized authority like James Martin.

He defined "relation" as "a flat file . . . a two-dimensional array of data elements . . . a file in normalized form." By implication, then, a relational data base is one that is made up of these data elements and a relational DBMS would be one that allows the user to recombine all of the elements in the data base to form different relations as required for its specific application.

Expressed another way, a relational expression is more like calculus — a "black-box operation" as opposed to the perhaps more familiar algebra that requires the student to perform all operations himself, Weeks pointed out.

In order to be considered relational, the DBMS should also be accessed through some sort of nonprocedural language, according to Eugene Wong, vice-president of Relational Technology, Inc. (RTI). This makes it possible to utilize the data without knowing how it is structured or organized.

Is there such a DBMS and what, if any, are the drawbacks to using it? The answers to these questions vary depending on who is asked — an unsurprising situation in high-technology and academic circles.

The issue has perhaps been confused because there was a period of time when several vendors used the term as an advertising ploy, according to Stephen Robinson, president of S.L. Robinson and Associates. These firms have since changed their advertising copy to include terms such as "relational-like" or "offering many of the features of (relational data bases)."

In any case, a look at three products announced in 1980 may give clues as to next year's data base releases.

Oracle made its debut from Relational Software, Inc. (RSI) in June [CW, June 30], and both RTI's Ingres DBMS and Computer Resources, Inc.'s (CRI) Relate/3000 were introduced in December [CW, Dec. 8, 15].

While all three vendors describe the packages as "relational," it is too early to obtain opinions from a statistically significant number of end users. However, a Cullinane Corp. representative described Ingres as a DBMS that might be considered relational several months before it was officially introduced. Versions of the Ingres system had been installed on Digital Equipment Corp. PDP-11s for several years by the time the DEC VAX-11 versions were announced this year.

It becomes apparent that some of the DBMS vendors — Cullinane developed and markets the Integrated Data Management System (IDMS) — are keeping tabs on changing DBMS concepts.

Contacted during a small telephone survey of Oracle users, Hank Rush, manager of data base support at Texas Eastern Corp., was asked whether Oracle was truly relational. He summed up the opinions expressed by most of the DBMS small user base with, "That depends on your definition of relational."

Ease of use for end users through user view formats, data representation in tabular format and nonprocedural supporting language were what Rush wanted. After an eight-week test period through a time-sharing service while waiting for VAX-11/780s to be delivered, Rush felt that Oracle would meet these criteria.

But, there may be some drawback to all three products. They have not been around long enough for users to judge their performance on large volumes of data. In fact, Oracle does not have a high-speed loader, according to an evaluation performed by DP consultant Stephen Wright [CW, Nov. 10]. This feature is required in order to process large amounts of information efficiently, he said.

It is also true that both the RSI and RTI products are currently tied to DEC gear and Relate/3000 only runs on the HP 3000 mini. Users with IBM and IBM-compatible mainframe operating systems will have to wait until at least one of these vendors announces a mainframe version of its DBMS. RSI had indicated that such an announcement was originally planned for this December, so it would be reasonable to assume that Oracle for IBM 360, 370, Series 30 and 4300 CPUs will arrive during 1981.

However, DBMS specialists agree that relational data bases probably will not be cost-effective for applications that require extremely large data files until a technological breakthrough — quite possibly involving hardware — takes place.

One problem arises when the logical table structures being touted as a selling point by the relational DBMS vendors are mapped on the physical computer files. Given current storage constraints, these structures are "useful as a starting point," but "don't lend themselves to very nice mappings right now," Robinson noted.

There is also difficulty with effective interfile communication, Robinson pointed out, which will only be solved for large files with some sort of breakthrough such as the development of associative memory. Interfile communication problems for any general-purpose relational DBMS disappear when small files are being processed, he explained. Small amounts of data allow one to read all of the files into core at the same time and communication problems are eliminated.

Robinson described it as associative memory and a Cullinane technical specialist called it "content addressable storage." Whatever its name, this type of memory has yet to be made available to commerical users, but is needed for efficient processing of relational data bases, according to the Cullinane spokesman. Until this concept becomes a reality, the technician has to design a system that allows duplicated keys to be hooked together in an inverted manner, he said. At that point, he essentially is working with an inverted list — something already offered by several mainframe DBMS vendors.

Once such a breakthrough is made, the trade-offs tied to a decision between DBMS structures might disappear, Robinson claimed. For example, an inverted list structure designed to be good for ad hoc inquiries is less efficient for update processing since indexes may have to be modified when an update takes place. Hierarchical structures make data modification easy, but ad hoc retrievals become more difficult.

Don't look for this memory breakthrough in 1981, though. Opinions vary among consultants, but several more years may pass before large corporations will be able to implement a relational DBMS for massive amounts of data.

Shoor is senior editor, software, at CW.

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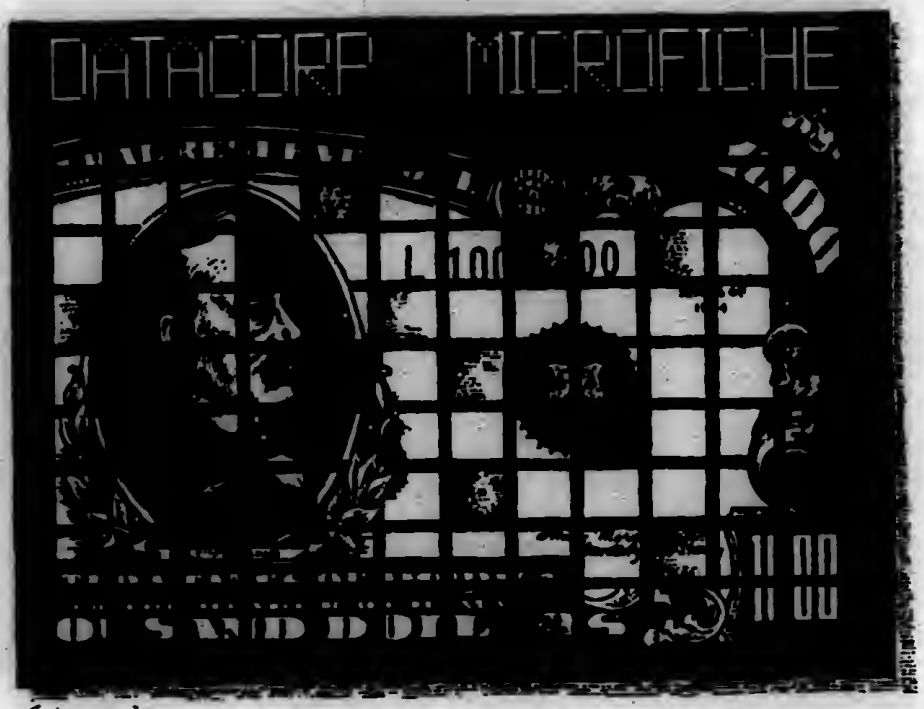

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FORECAST 81

By William F. Zachmann

SIX TECHNOLOGIES HOLD THE KEYS TO THE FUTURE OF COMPUTING

Suppose you were asked to take over the management of a large data center housed in a brand new building. All the most modern architectural conveniences would be available. A big budget would be at your disposal and a staff of experienced professionals. Just one small thing you ought to know, however . . . you are to use computers that are 20 to 25 years old. You can, of course, pick the ones you want. What is your preference? A Univac II perhaps? An IBM 650 or 709?

Absurd? Of course. Yet, the fundamental hardware and software architectures in place in nearly every large installation today are nearly of that vintage! True, the actual hardware implementations have changed a great deal over the past 20 to 25 years. But the architectures which are implemented in the newer and faster hardware have not.

Cobol and Fortran, for example, together account for some 65% to 70% of all programming done in large computer installations. Cobol dates from 1959 and the first Fortran manual was published in 1956. The basic Von-Neumann machine architecture has been with us even longer, and the specific architecture which accounts for more than 70% of all commercial use today (the IBM 360/370 architecture and instruction set and OS operating system) was developed in the early 1960s and introduced in 1964.

When you look at the way technological change occurs, you find it has some very interesting properties. Although it may appear, superficially, that technological innovation moves along gradual curvilinear paths, the underlying pattern is somewhat different. Technological innovation, at its core, has properties very similar to those found in the quantum states of substomic particles: It moves discontinuously.

Just as an electron in an orbital shell of an atom tends to remain in a state of dynamic equilibrium until internal and external forces combine to move it across a quantum discontinuity to another, higher, energy state, so, too, does technology. Technology tends to progress along a fairly straight path until a combination of internal and external factors builds enough force to deflect it.

The internal factors which affect changes in technology include the available knowledge which accumulates in academic and other research environments, channels for the transfer of technology into applications environments and inherent gains available from the newer technologies. External factors include the economics of production for new technologies, marketplace characteristics, potential benefits from the introduction of new technologies, amount of investment in older technologies and the extent to which that investment has been depreciated.

The last major change in computer architecture and software came in the late 1950s and early 1960s. This coincides with the beginning of widespread acceptance and use of Cobol and Fortran as programming languages. The period is capped with the introduction, in 1964, of the IBM 360 architecture and the OS operating system. All developments in the marketplace since then have fundamentally remained within the framework laid down at that time. Introduction of virtual operating systems, faster and more dense logic and storage technology, and those operating system and software innovations which have achieved acceptance thus far have yet to venture outside that framework.

The most recently shipped IBM 3033 or 4300, or Amdahl Corp. V8, and even (so far, at least) the recently announced IBM 3081 and Amdahl 580, still offer no more than a proper superset of the architecture and basic instruction set of the first IBM 360s shipped over 15 years ago. We have come to take these fundamental hardware and software architectures so much for granted that we begin to operate on the hidden assumption that they are somehow fundamental to the use of computer technology. In fact, they are not.

While the last major change in computer and software architecture is now nearly two decades behind us, the next such major change will occur within the next three to five years. The impact of this change will be substantial and will catch many users and vendors very much by surprise. This will happen precisely because we have grown so accustomed to the current technologies and have come to believe that relatively minor technological innovations within the commonly accepted architectures are all that is possible.

The next half decade will see the introduction of radically new approaches, hardware and software, to the development of computer/communication systems which will render many of our assumptions obsolete and untenable. *The ability to cope with these changes will not be merely a matter of casual interest. It will be a major survival requirement for users and vendors alike over the next decade!*

Many of the individual elements of technology which will play a part in these changes have been known in academic and research circles for some time. What is more, the coming changes, though radical and fundamental, will hardly change things overnight. Ten years from now there will still be installations using Cobol and the 360/370 architecture. There are still installations today running 1401 emulation. But these will not be the leaders in their industries.

The next half decade will see the emergence of the technologies which will shape the use of computer/communication systems over the next two decades. During the latter half of the 1980s widespread acceptance and dissemination of the new technologies will occur.

Our recent research on the computer/communications industry has resulted in the identification of six key technology areas which we believe are critical areas to watch for indications of the direction the industry will go over the next few years. The six interrelated areas of technology are:

- Very large-scale integrated circuits (VLSI).
- Bus architectures.
- System specification methodologies.
- Extensible languages.
- Higher level software.
- Hard software.

VLSI provide the foundation for the changes in technology and system architectures which will come about in the next half decade. VLSI has been compared to the invention of the fractional horsepower motor in manufacturing, and quite rightly so. Prior to the invention of small motors which were cost-effective for manufacturing use, the machines in a factory were

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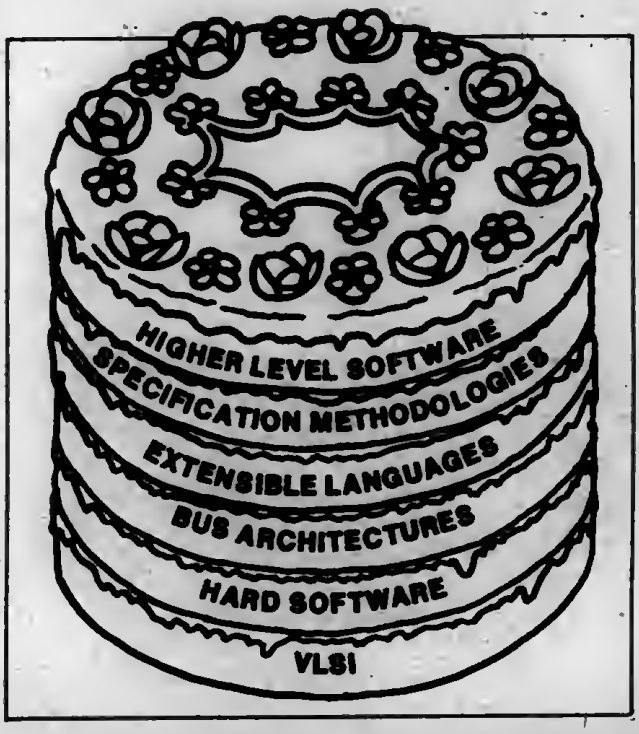

Zachmann is research director for the Information Systems Planning Service at International Data Corp. in Waltham, Mass.

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(Continued from Page 15)

typically driven by leather belts from large overhead shafts. The shafts were turned by a large central power source: a water wheel or a very large steam engine. This has a remarkably close analogy to the pattern of relatively "dumb" terminals serviced by a large central computer.

With the availability of economical fractional horsepower motors to drive machinery of all sizes, manufacturing became possible in increasingly flexible ways. Eventually, this led to the home tools with which we are all familiar: chain saws, electric drills, sanders and table saws. In addition, small motors made possible applications which the old factory belt drives could never have provided: electric kitchen appliances from the dish washer to the Cuisinart, toys and electric razors.

VLSI does for computing power very much the same thing which the fractional horsepower motor did for mechanical power: it makes it available in a cost-effective way in a variety of "sizes" which can provide computing power when and where it is needed. Already seen is the application of VLSI in automobiles, home appliances and games, as well as in the development of distributed resources computing systems. VLSI is having a broad range of impacts from business to home entertainment. Yet, thus far, we are only scratching the surface.

Just as the early motor cars were called "horseless carriages" and were built as if they were that, so the early use of VLSI tends to apply it according to older models of use. We are beginning, however, to see VLSI being applied in newer, more innovative ways. This will be a rapidly accelerating trend.

Functionality Issue

Increases in speed and circuit density and decreases in cost will, of course, continue. The real issue, however, increasingly becomes one of functionality, of what we wish to do with the technology. More and more we begin to see the problems of VLSI design as programming and applications problems. Rapid growth in the use of gate array chips highlights this. The gate array chip is essentially a "programmable" chip which allows the designer to "wire" the last layer or layers on a generalized gate array very much like we wired plug boards on IBM 401 accounting machines and EAM equipment 20 years ago.

Bus architectures, the second area of technology, refers to the growing implementation of system architectures in which hardware modules in a computer/communications system are linked together via standard interfaces on a common communications bus. Systems built in this way can be thought of as hardware counterparts of modularized structured software systems. Initially achieving widespread acceptance in the development of the internal architecture of minicomputer and microprocessor-based systems, bus architectures are now being increasingly used in the development of large scale computer systems.

The most exciting area of application, however, is in the development within the last decade of effective bus architectures for local area networks. Time division multiplexing (TDM) using carrier sense multiple access (CSMA) protocols on a local network bus can be expected to be a major growth area in the next few years. While much of this activity may be in the form of baseband systems such as Xerox Corp.'s Ethernet, we feel the most significant action will come in the use of broadband radio frequency (RF) modulated systems using community antenna television (CATV) coaxial bus architectures such as that developed by Mitre Corp. and those recently made available by vendors such as Amdax, Network Resources Corp. and Digital Communications Corp.

Ultimately these bus-based local area network systems will result in major changes in the way we design and develop operating systems as well as application systems. They will result in truly distributed systems in which there is no real hierarchy in the system (i.e., no single central computer or computer complex). This will also lead to much simpler communications implementations and less complex standards requirements than those implicit in protocols like X.25 or Systems Network Architecture (SNA).

Availability of VLSI components provides a key element in the implementation of bus architectures. Bus architectures, in turn, will require assistance from the third of our six key technologies: new system specification methodologies.

Strict Separation

We have been seeing a great deal of activity recently in attempts to develop methodologies for specifying large or complex systems. What is required here is a rigorous (possibly axiomatically based) system which permits a strict separation between the specification and the implementation of a system, is machine independent and allows the specification to be independent of hardware/software interface boundaries. Such a system would provide automatic static validation and verification of the specified system and ultimately will lead to automated implementation.

The typical system design cycle as traditionally followed (feasibility study, general design, functional design, detail design, code and test, install, maintain) does not sharply separate design from implementation. This is true even in the most advanced installations. It is still common for the individual who must finally sit down to write code for a module to find that he must resolve remaining design questions. Attempts to organize MIS divisions with separate groups for programming and for analysis regularly come to grief because of this problem.

Recent developments in this area, such as the Higher Order Software (HOS) methodology developed by Margaret Hamilton and Saydean Zeldin, are beginning to show real promise in solving some of these prob-

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lems. Along with work on systems such as Srem, PSL/PSA and Sadt, methodologies such as HOS can be expected to become available in usable forms over the next few years.

Alternative Languages

Closely related to these methodologies is renewed interest in alternatives to Cobol and Fortran for programming languages. We have been closely following the growing interest in Pascal and Ada in recent months. Ada, the newly developed language from the Department of Defense, represents a "top down" movement to bring in a new standard language for DOD applications. On the other hand, Pascal can be said to represent a "bottom up" movement where a very large number of students and micro computer users are learning to use and value Pascal. Both Pascal and Ada are in the Algol language family derived from the original Algol syntax. All offer inherent advantages for structured programming and are held by many experienced programmers to be greatly superior to Fortran and Cobol.

These are only the start, however. Much current interest also centers on languages such as Forth and C. The next few years will certainly see much discussion and ferment on the virtues of various languages. We will see significant growth in the use of newer languages at the expense of Cobol and Fortran.

It seems quite likely that additional languages will be developed and that they will go beyond the language features already available. In particular, we expect that truly extensible languages which are hierarchically composable and functional in architecture will eventually prevail both for commercial and scientific applications.

This means that extended functions will be maintained by the language facility itself rather than in external libraries and implies substantially different interfaces to operating systems than those common in the IBM OS/VS world today. We need to look to systems like UCSD Pascal and the Unix operating system to get an idea of what the newer operating systems will look like.

The newer extensible languages will also require very large address spaces in the hardware supporting them and will be capable of employing radically different I/O interfaces. More and more noticeable will be ways in which data which would have been handled by I/O to random access disk storage will begin to look like it is within the internal address space of the program or be accessed with high-level DBMS-like syntax. We will also see data flow computational model features allowing for multiple concurrent asynchronous processes and event-driven processes within the language syntax.

While new specifications methodologies and extensible languages will increasingly become part of the domain of the computer specialist, the fifth of our six key technologies, higher level software, will play a very important role in providing end users with powerful facilities for entering, manipulating, and accessing data. The higher level generalized software will grow out of present leading-edge data base management systems with powerful functionality in high-level syntax such as NCSS or Nomad.

Internally, this software will be developed through the use of specification methodologies and extensible languages. Externally it will be linked with things like color graphics terminals and voice synthesis and recognition to provide user friendly facilities. It will also employ natural English syntax translators such as the Robot or Intellect system developed by Artificial Intelligence Corp.

In addition to providing a complementary alternative to the new system specification methodologies for end user access, this kind of software will allow widespread use of "breadboarding" for the development of ad hoc decision support systems and prototypes of operational systems for large systems. This, too, will require major changes in the way users interface with the operating systems on large machines and will be accompanied by highly automated facilities for managing structured collections of data.

Finally, the sixth of the key technologies, hard software, closes the loop that opened with VLSI. Hard software primarily refers to the increasing implementation of key software functions in hardware in the form of specialized VLSI chips. We are already seeing this in the various hardware assist options for key operating system functions from IBM and others. With the decreasing size and cost of circuits, hardware implementation of software functions becomes economically much more viable.

Highly modular designs for systems based upon bus architectures and extensible languages provide the environment in which frequently used modules can be implemented in hardware. This also extends to analog as well as to digital circuits.

Unfortunately it is not possible to discuss all the ramifications of these six key technologies in the space available here. They are not merely an arbitrary collection but represent six closely interrelated technologies which will have a crucial impact on the way computer/communications systems evolve over the next few years. By rearranging them (see figure) in the form of a six-layer cake, we can suggest the way each is founded upon and carries forward the impact of the others.

The present period is really the calm before the storm of technological change. It is characterized by a consensus opinion that is not expecting a big change. That opinion is wrong. We are about to enter the most exciting period of change since the first widespread use of computers. Users and vendors who are alert to the change have an unparalleled opportunity to move to the forefront.

For those prepared to meet the challenge of the new technologies head on, the 1980s promise to be an exciting era of constructive innovation of a kind seen only once every generation or two.

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By Phil Hirsch

TELECOMMUNICATIONS OUTLOOK FOR '81:

ANOTHER 'BELL BILL' IS ON THE WAY

WASHINGTON, D.C. — The big question facing the nation's telecommunications policymakers next year will be how to structure the Bell System so as to maintain the quality of present services while promoting technological innovation and competition. It is not exactly a new problem — some of the underlying conflicts go back to the 1950s. Despite the intervening years, neither Congress, the Federal Communications Commission (FCC), nor the courts have yet found a structure acceptable to the phone company and its adversaries.

It is likely, though, that a compromise of sorts will be hammered out during the coming year.

According to one observer here, the Reagan Administration will order the Justice Department to negotiate a settlement of its pending antitrust suit against AT&T. This rumor seems to have sprung from Reagan's comments opposing divestiture as a remedy for violations of the Sherman Act. Although he was referring to a pending Federal Trade Commission (FTC) suit against the nation's breakfast cereal makers, Reagan's statement has been interpreted to mean he opposes the Justice Department's efforts to dismember AT&T.

Even if such a settlement is negotiated in the coming year, AT&T's opponents almost certainly will appeal it to the U.S. Supreme Court — a move that probably would delay a final decision until 1982 or later.

Behind this negotiated settlement rumor is an unstated assumption: the new administration, because it is allegedly more partial to business interests than the Carter team was, will favor AT&T. However, some Bell antagonists are also members of the business community. They include Xerox Corp., whose chief Washington attorney is Richard Wiley, one of the incoming president's key advisers. Another adviser is Walter Hinchman, former chief of the FCC Common Carrier bureau. He has been insisting for some time that divestiture offers the only real hope of making AT&T behave.

Another much discussed possibility is that in the coming year the Senate will pass a new communications act, which will allow AT&T to offer "enhanced," i.e., computer-based, on-line services on a deregulated basis through one or more separate subsidiaries.

AT&T favors such a scheme, as does Sen. Robert Packwood (R-Ore.), new chairman of the Senate Commerce Committee. Furthermore, Packwood said recently that he wants Congress, not the courts, to determine AT&T's corporate structure. If he really means it, a new communications act probably will have to be out of the Senate by this time next year because there is a good chance the Justice Department's antitrust suit against AT&T will be decided, at least initially, in 1982.

One way of estimating how quickly the next Congress can rewrite the Communications Act of 1934 is by looking at what happened in the last session.

Last summer, the Senate's proposed rewrite (S. 2827) died in committee because of a fight over language in section 205(b) allowing the FCC to restructure AT&T if the commission felt such a change was needed. The committee leadership — Sen. Ernest Hollings (D-S.C.) and Sen. Howard Cannon (D-Nev.) — refused to begin final markup unless the phone company withdrew its objection to this provision. Packwood, however, felt the markup should proceed despite Bell's objections.

"The committee members are capable of wrestling with these complex issues . . . I don't think this legislation should be fully orchestrated before the markup," he said.

Reportedly, it was not lack of faith in the committee's judgment that kept Hollings and Cannon from bringing the bill to a vote, but a much more prosaic consideration. "Packwood had the votes to kill section 205 (b)," said a knowledgeable source.

In the House, the same basic issue arose. The House Commerce Committee passed a bill (H.R. 6121) explicitly barring the FCC, in Section 219 (g), from changing AT&T's corporate structure. The House Judiciary Committee, however, blocked a final Floor vote because it felt the bill was "not acceptable" and there was not enough time left to make the needed changes. Significantly, one of the proposed amendments cited in the committee's report was a proposal to assert FCC authority over the internal relationships among AT&T's corporate components.

Although Republican representation on the Judiciary Committee will increase somewhat in the new Congress, the committee's views concerning telecommunications policy "aren't likely to change," according to a spokesman. Thus, even though Packwood's promotion to chairmanship of the Senate Commerce Committee removes one major obstacle that confronted AT&T in the last Congress, the other remains.

It would be a mistake, however, to conclude that the House Judiciary Committee's views, even if they are not likely to change, will not do so under any circumstances. Often things happen outside of Congress that cause a seemingly magic transformation of legislative perceptions, and that may be what is starting to occur in the case of the effort to rewrite the Communications Act of 1934.

AT&T recently announced, unofficially, that it will take the FCC's "final" computer inquiry decision to court. This refers specifically to the provision allowing the phone company to offer enhanced services through one or more deregulated subsidiaries.

Much of the opposition to the Second Computer Inquiry Decision is based on the agrument that this "enhanced services" provision violates AT&T's 1956 consent decree. Basically, the decree says the phone company can offer only regulated communication services. Bell wants the court to endorse the commission's view, which says that allowing AT&T to offer enhanced services will not violate the decree because those services are "incidental to" presently regulated communication offerings (the decree specifically allows "incidental" services) and will remain "subject to" FCC regulation.

Several computer hardware/software vendors and their trade associations are in the forefront of those opposing the FCC's logic. Partly, this is because the argument implies the commission can regulate any enhanced service, including those offered by on-line service bureaus. Mostly, however, critics of the computer inquiry decision argue that the FCC has ignored the main purpose of the decree. The most concise statement of this latter point was made by the Computer & Communications Industry Association (CCIA) in one of the innumerable comments submitted to the commission during the inquiry.

Citing statements made by AT&T in 1958, two years after the consent decree was signed, and a more recent comment by the Justice Department to the House Commerce Committee, CCIA argued that both parties interpreted the decree to mean "AT&T would be confined to the regulated communications field, where its monopoly power could be regulated by

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Hirsch is senior writer, communications, at CW.

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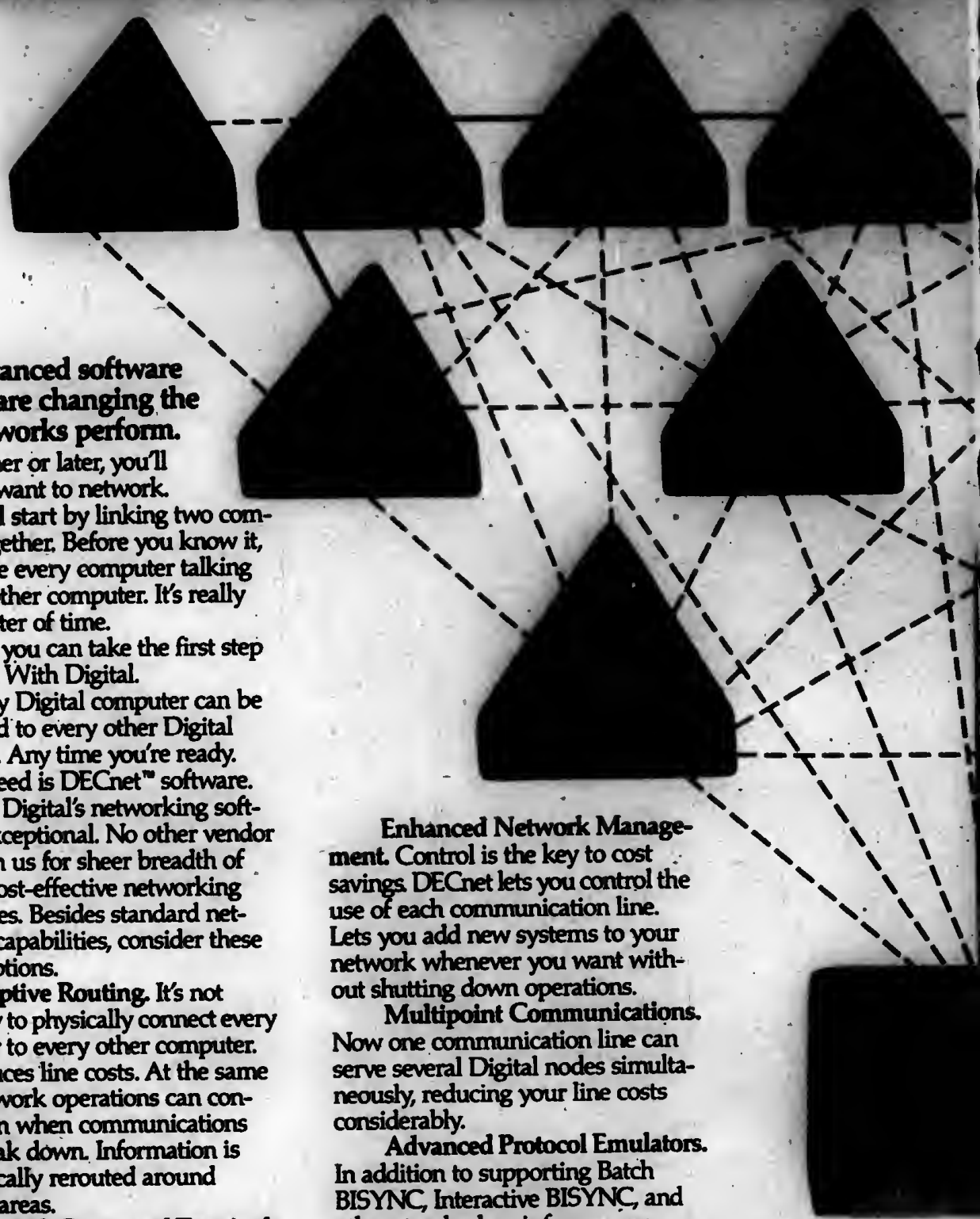

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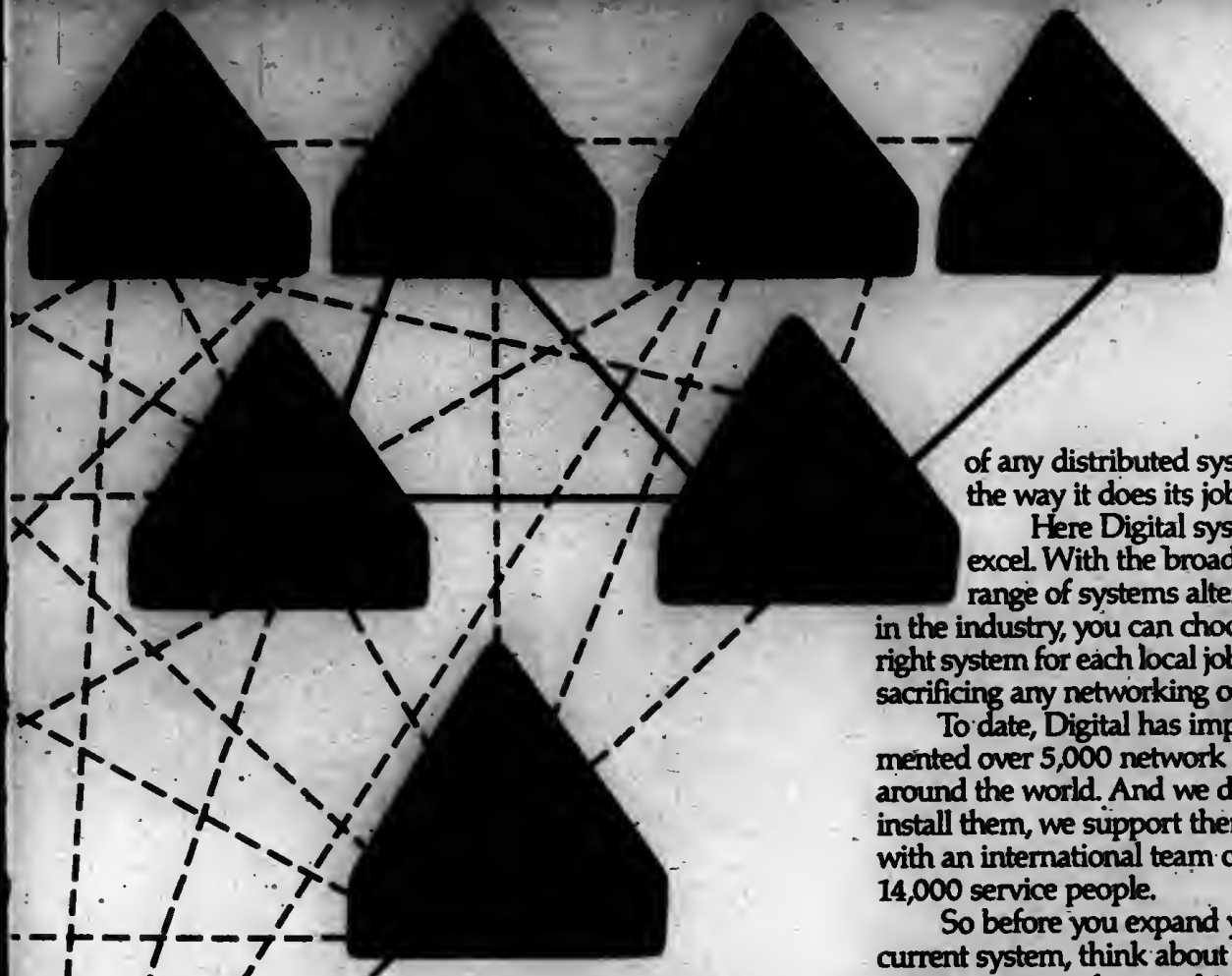

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(Continued from Page 19)

the commission.

"The Justice Department statement clearly reflects the rationale that AT&T was permitted to retain its vertically integrated structure on the basis of such restrictions; conversely, participation outside of its 'traditional arena' would be appropriate only if predicated on structural change . . . in the Bell System," i.e., establishment of Western Electric and Bell Labs as independent companies.

To suggest that the decree allows AT&T, as presently structured, to enter an "adjacent, unregulated market such as data processing," CCIA added, is contrary to the meaning of the decree as defined by AT&T and the Justice Department in the cited statements.

There is nothing particularly new about these objections. The quotes were taken from a statement CCIA submitted to the FCC last June, and even earlier expressions of the same basic idea are available. What makes the whole consent decree argument relevant for 1981 is the political change that has occurred in Congress together with AT&T's decision to seek the New Jersey federal district court's approval of the computer inquiry decision.

Major Obstacle

Now that Packwood is the new chairman of the Senate Commerce Committee, the only major obstacle preventing enactment of a communications act acceptable to AT&T is the House. More precisely, it is the House Judiciary Committee, since the House Commerce Committee, as indicated by the bill it passed in the last Congress (H.R. 6121), has already accepted the idea that separation rather than divestiture can adequately protect the phone company's competitors.

Reportedly, Rep. Tim Wirth (D-Colo.), the likely successor to Lionel Van Deerlin (D-Calif.) as chairman of the Commerce Committee's Communications Subcommittee, wants a "stronger" bill than last year's version. But among Wirth's constituents are several thousand members of the Communication Workers of America, which shares Bell's legislative views.

The judiciary committee is another matter. In the report it published shortly after blocking a final House vote on H.R. 6121 in the last session, the committee developed several paragraphs to a discussion of the consent decree.

"Antitrust settlements or agreements involving AT&T have been major watersheds in the company's history," said the committee. "The 1956 consent decree . . . [has] taken on even more significance because of the Bell System's decision to enter the data processing field."

There was "little disagreement" among the witnesses who appeared before the committee during its deliberations on H.R. 6121 concerning the impact of Section 218, the provision allowing AT&T to offer enhanced services and terminals on a deregulated basis through one or more separate subsidiaries. "Except for the testimony of the AT&T representative and the Assistant Secretary of Commerce [Henry Geller], the witnesses . . . expressed strong misgivings about . . . lifting . . . the . . . decree . . . Assistant Attorney General [Sanford] Litvack . . . was convinced . . . nothing had changed since 1956 to eliminate the anticompetitive incentives that underlay the decree. Since the decree was entered by a court, be preferred 'to see the court deal with [it].'"

This last statement suggests why AT&T has decided to ask the New Jersey federal district court to declare that the computer inquiry decision does not violate the consent decree. As a judiciary committee spokesman pointed out, if the court accepts the phone company's argument it would carry a "great deal of weight" with the committee. The implication is that a majority of the members would then agree that Bell can offer enhanced services on a deregulated basis through one or more separate subsidiaries, thus clearing the way for passage of a new communications act acceptable to the phone company.

It is far from certain, of course, that the New Jersey court will agree with AT&T. Even if it does, CCIA and other opponents of the FCC/AT&T inter-

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pretation will appeal the decision. That may help rather than hinder Bell. If a final judicial decision is delayed, Congress probably will enact a new communications act before the verdict is in.

Packwood, as mentioned earlier, clearly wants Congress, not the courts, to resolve the structural question. At a recent press conference, after observing that he believes "a substantial portion of [the Bell System] can be split into separate subsidiaries," Packwood said he is "prepared to go ahead and introduce a bill early next year" if the Reagan Administration does not draft one of its own.

Later, an informed source said Packwood was not suggesting Congress should supersede or set aside a court decision specifying AT&T's corporate structure; rather, he wants Congress to decide the question before any court verdicts are announced.

It may be significant that news of AT&T's plan to seek judicial review of the computer inquiry decision surfaced immediately after Packwood's press conference.

All of this suggests that Bell's best strategy would be to present a convincing argument in the trial phase of the antitrust suit, scheduled to begin next month in Washington, and to ask for a hearing in New Jersey as soon as possible. If the company's lawyers are sufficiently persuasive in that forum as well, they should be able to convert at least some of the legislators who opposed last year's communications act rewrite.

AT&T Strategy

One argument Bell seems likely to make in New Jersey is that unless the consent decree is clarified, the phone company will be undertaking a substantial risk if it continues to market terminal equipment, and may decide not to do so as a result. The reason: The computer inquiry decision detariffs this equipment, and several critics, including the Justice Department, contend the consent decree prohibits Bell as well as its subsidiaries from offering terminal equipment on that basis.

The other main element of Bell's strategy is to delay final action in both court proceedings until Packwood and his associates can enact the kind of bill they seem to have in mind. If the legislation can be enacted first, it will indicate in unmistakable terms that Congress wants AT&T to offer enhanced services and terminal equipment on a deregulated basis, regardless of what the consent decree may say, and that it also does not want the Bell System broken up despite the Justice Department's contrary views.

Since Congress has been arguing about telecommunications policy for at least five years without accomplishing very much in terms of legislation, there is certainly a possibility it will not enact a bill soon enough to influence the court proceedings. But this may not be necessary. If the legislation gets through one chamber by this time next year, such as the Senate, Bell will probably gain valuable leverage. As a result, one of the key battles in the coming Congress is likely to be procedural. The phone company's opponents almost certainly will do whatever they can to prolong the committee debate.

While no one can predict at the moment whether the phone company's strategy will succeed, it appears that AT&T, because of what happened last November, is in a far better position than a year ago. It is also probable that AT&T has only a limited amount of time. There will be another election in 1982. Before then, though, the legality of the computer inquiry decision and the Justice Department's antitrust charges probably will be established. Any one of these developments could destroy the phone company's present advantage.

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IBM AFTER H

By Tom Henkel

By mid-decade, IBM will be well into the throes of perhaps the most extensive product realignment to hit the information processing industry.

The H series, believed by many to be the fourth generation of computers, will be fully unveiled. The Sierra line, supposedly the successor to the H series, will also have been announced. IBM's 4300 line will have been expanded to the limit, offering more models along with attached processor and multiprocessor versions. And IBM will already be working on a replacement for its 4300 — the Olympic series, according to Advanced Computer Techniques Corp.'s Bob Fertig.

Amid this product realignment, IBM must also deal with changes in the computer industry. Time-sharing will make another big push during the 1980s, possibly giving IBM its hottest competition in some time. Old faces like Xerox Corp. and Westinghouse Electric Co. will reappear on the computing scene along with some more familiar faces, like AT&T, to give the processing via communications links new life, according to ACT's president and chairman, Charlie Lecht.

Cryogenics will be the hottest technological prospect of the '80s, and IBM will be struggling to be the first to come out with a true Josephson Junction computer.

While Lecht claims IBM will have a commercial version of a Josephson Junction computer on the market by 1985, others say it will come later in the decade and it will be well into the 1990s before the new technology becomes commonplace.

During this time of development and turmoil, IBM will have to face the biggest challenge to its status as the Number 1 computer company — software compatibility. The 370-era software is dying. It was designed for computers that operate in the .5- to 1 million instructions per second (Mips) range. But IBM's recently announced 3081 processor is a 10-Mips machine, and some analysts predict the top of the Sierra line will be a 50 Mips machine. IBM is already having problems making its top-of-the-line MVS/SP operating keep up on the 10-Mips 3081.

To boost power, IBM has announced changes like global resource serialization and cross memory [CW, Nov. 17] along with some yet unspecified changes in MVS/SP Release 3. But some minor revisions to 370 software aren't good enough, said Ken Harvey, former IBMer-turned-consultant with Toronto's Art Benjamin Associates.

The problem with IBM's software is it can only access 16M bytes of addressable storage. To make any real headway in improving its software, IBM has to offer at least 32M bytes of addressable storage.

"I'm not saying there isn't a workable solution; it's just not a simple matter to achieve. It costs you money to see any magic show, and the more impressive the magic, the bigger the fee to sit and watch," Harvey said.

Extending the addressability to 32M bytes is not a big deal in terms of hardware, but some IBM software may be severly impacted, Harvey said.

"It's got serious architectural limitations to deal with the 1,000 Mips [machine]. I'm not worried about the 3081, but 10 years from now when we have two or three orders of magnitude faster processors dealing with 100 times as much on-line storage at one-tenth the cost, file access methods will become a major burden," Harvey said.

The most viable way to get around the compatibility problem, Harvey says, is to create a new VM-environment and run MVS images under that.

"You can immunize a lot of incompatibility problems by leaving the things running directly under MVS the way they are. Then you can provide architectural extensions, managed by VM, as a resource manager," Harvey said.

IBM may be planning a step in that direction with its rumored revision of MVS, which Fertig calls MVS/E. Said to be ready for release on first shipments of the 3081, MVS/E will incorporate a new facility, a System Repository and Directory. This will act as a go-between for MVS and other IBM operating systems, like OS/VS1 and other subsystems like JES and IMS [CW, Dec. 1], ACT's Fertig predicted.

How IBM will solve the software compatibility problem is a subject of mutual interest to both IBM and users. Users are locked into 370-type software, just as IBM is locked into pleasing its users.

"The problem gets larger the longer IBM waits. It's not just the investment all the user community has made, but the dependency all IBM's software products have on a given hardware/-software assumption. Some of the products have been designed in such a way, either intentionally or otherwise, to be quite immune to major change. But a lot of them are so tightly ingrained (in the 370 era) they would need major surgery," according to Harvey.

The 370-era compatibility problem is deeply rooted in IBM hardware, too. Most analysts feel the latest 3081 processor is an appeasement to IBM's 3033 user base. Hence the processor — said to be the first model of the long-awaited H series — doesn't offer any new functions, or revolutionary advances in technology, according to ACT's Fertig.

Fertig contends IBM's next big line of processors, the Sierra series, will be much the same story in terms of 370-era appeasement as the H series — although he is quick to point out the true colors of the 3081 have yet to be revealed.

The first big test of IBM's answer to the compatibility problem will come in the H series native mode. The 3081 was announced as a big brother to the 3033, but both Fertig and Gartner Group analyst Tom Crotty agree IBM will announce a new native operating mode, and more functions with subsequent models.

"I think it's going to be more than a glorified 370," Crotty said, explaining IBM plans to use the 3081 "as a springboard to the future."

The first jump on the springboard will come in the first half of 1981, when IBM is expected to make a flurry of product announcements. Four new models of the H line, along with the somewhat mysterious native mode, and a 4341-2 AP will be announced, Crotty predicted. Fertig added IBM will also announce a high-speed tape storage unit to support the recently announced 3380 and 3375 disk drives. A front-end processor and a new 370X communications controller will be announced in the first three to six months of 1981.

When the first models of the H line are shipped, in early 1982, Fertig says IBM will also announce its much talked about relational data base, System R. While Fertig said that announcement will come as a big plus to the H series, it won't immediately kill IBM's IMS data base.

How will the users react to this flurry of announcements? Dr. Ulric Weil, vice-president of EDP research for Wall Street's Morgan Stanley, Inc., said they will probably take it all in stride.

Using the recent 3081 announcement as an example, Weil said IBM users will continue buying older IBM CPUs even when they know IBM will be announcing newer technology. This phenomenon was visible in a 3033 buying spree just prior to the 3081 announcement in November. Users seemed willing to purchase 3033s knowing IBM would soon cut prices in conjunction with the H announcement, he said.

Weil said IBM's pricing structure is also in a state of flux. The once-famous IBM price umbrella is gone, Weil said, adding IBM pricing used to be the most predictable around. Purchase prices on processors would remain steadfast until about three weeks prior to a new announcement. Then IBM would cut prices and stage a "fire sale" to make way for the replacement system orders.

Rent and lease prices too were very predictable. Prices remained virtually unchanged except for periodic 2% to 3% increases to offset higher maintenance costs, Weil said.

Now IBM has found frequent price changes can keep the plug-compatible manufacturer (PCM) competition off balance. Pointing to the 3033 line, Weil said IBM has made three purchase price cuts in the past year. It cut prices when it announced the 3033N, it made some back-door price cuts when it raised rental and lease prices in mid-1980 and it cut purchase prices again when it announced the 3081, Weil said.

The fluctuating pricing schedule will continue with the H series and future models, Weil said, theorizing IBM may be using the new pricing strategy as a defense against what seems to be a sag on the design and technology fronts.

But the price cut works well. When IBM cuts prices, the PCMs have to do the same. Price cuts come out of unit profits, and IBM has more profits to play with than the PCMs, Weil said.

Weil noted any loss in profits hurts, but it hurts the PCMs more. And price cuts coupled with technological advances hurt the PCMs even more.

ACT's Fertig disagrees with Weil's pricing philosophy. Fertig contends IBM will step back under the pricing umbrella and offer processors that can easily be enhanced to offer more power. In either case, the effect is the same; IBM seems to be determined to keep the PCMs off balance for the next decade.

Where IBM will turn for future revenues is unclear. There are several viable options, and IBM doesn't seem to be favoring one over the other.

ACT's Lecht said IBM's relationship with Satellite Business Systems (SBS) will be a key to what direction the firm will take.

IBM owns 47% of SBS, and Lecht pointed out that is more than IBM owns of IBM. That suggests IBM has a deep-seated interest in SBS — possibly as a long-haul communications supplier for a satellite-directed processing service. That would mean IBM plans to compete head to head with AT&T as well as some old computer companies, like Xerox and Westinghouse, that seem to find new life in the time-sharing business.

(Continued on Page 26)

Henkel is a staff writer at CW.

(Continued from Page 25)
the time-sharing business.

The satellite concept may not be all that far out. SBS just launched a satellite, and IBM seems to be the key beneficiary of it. Lecht says the two other principals in SBS, Aetna Life Insurance and Comsat General, could only make minimal use of the satellite.

"SBS can't make a move without IBM's consent," Lecht said, noting the strangle-hold interest in SBS suggests top IBM brass feel the subsidiary is vital to IBM's future.

Services Route

While most analysts agree IBM will eventually go the computer services route, exactly when is a big question. Gartner's Crotty said IBM won't offer computing services until it comes up with some way to secure data, whether through encryption or some other means. And the Gartner Group analyst couldn't hazard a guess on when that would be a reality.

Service bureau-type services may not be a panacea either. Big IBM users don't like the idea of losing control over their information processing systems, according to, Dave Smith, a consultant for Exxon Corp., one of IBM's biggest clients. Smith said Exxon has gone as far as to build its own power plants because it didn't like the quality of power supplied from public utilities. He also added Exxon wouldn't hesitate to maintain existing computers and possibly build its own large systems if IBM did not offer hardware and software.

Weil said that at least for the short term, IBM plans to stay in the hardware business. But Weil also predicted that by 1987 IBM will be making more money from non-hardware items, namely, software and maintenance, than it will on the actual hardware. IBM has said that switchover in primary revenue won't come this decade, but it didn't disagree with the premise, Weil noted.

Instead of getting out of the hardware business, as Lecht suggested, Weil said IBM would like to step up its production cycle of about five years, from design to finished product, to around three years. Weil said that's impossible in a bureaucracy the size of IBM. But, he added, four years is a possibility. That, accompanied by the aggressive pricing strategy IBM has used on the 3033 line, could severely impact the PCMs.

The PCMs don't seem to be worried — at least on the surface. F.T. White, president of Amdahl, Ltd. — the Canadian subsidiary of the U.S. Amdahl Corp. — said it may take Amdahl a year after the first customer shipments of the 3081 to meet some of the new functions IBM is expected to announce.

The PCM industry will be able to deal with H series changes the same way it dealt with "the microcode mirage" in the 4300 and 30 series systems, White added. But amid his confidence that the PCM industry can handle anything IBM can dish out, he also showed some intimidation. For example, he would not address IBM by name; he would only call it "the dominant supplier."

White said Amdahl plans to delve more deeply into the software business in hopes of cashing in on some areas where IBM is lacking.

"Software expertise offers the opportunity for both an offensive as well as defensive strategy to deal with the vagaries of the dominant supplier in the software area. As the dominant supplier looks increasingly to software as an additional revenue source, so must the PCMers," White said.

Weil said he may be right.

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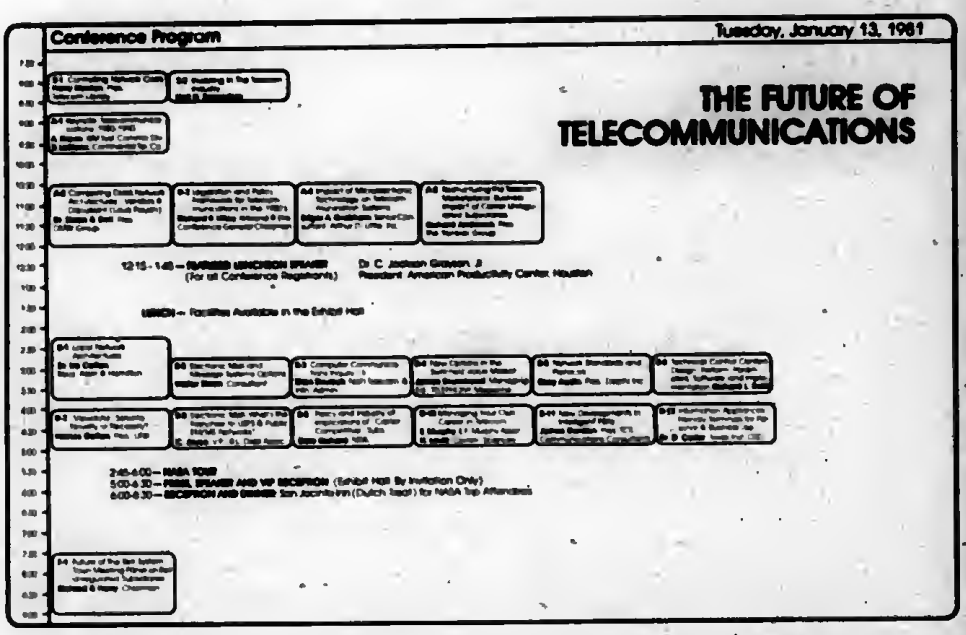

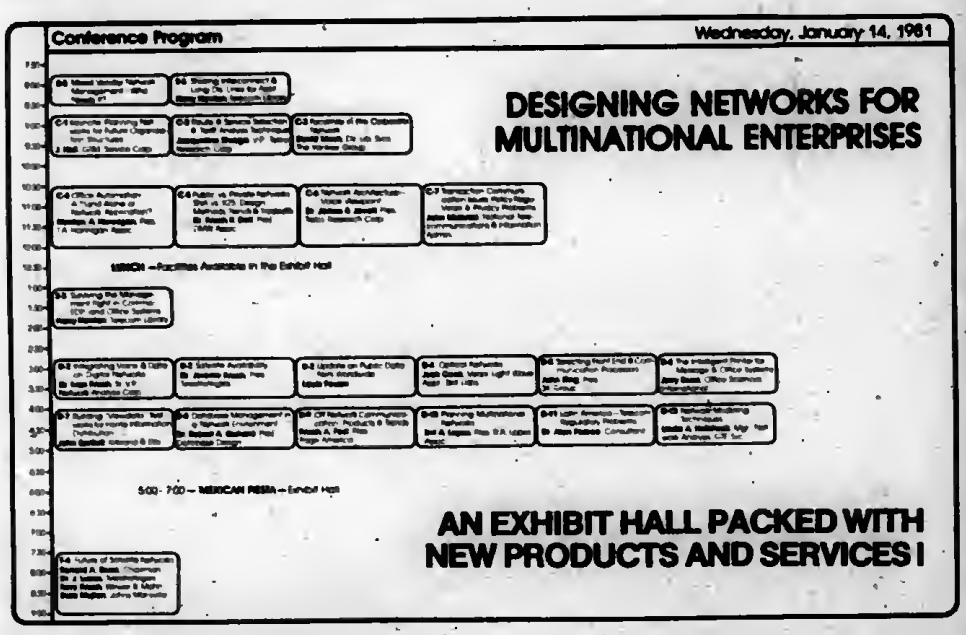

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but only because IBM allows it. IBM's view of the PCM industry is a love-hate relationship. While IBM doesn't like losing revenue — several million dollars on large systems like the 3033 — IBM also needs the PCMs to produce in-between processors that eliminate what former Amdahl president Gene Amdahl calls "FUD" (fear, uncertainty and doubt) among IBM clients. Weil noted that while IBM may lose some business to PCMs like Amdahl, it has a long-term advantage in knowing those clients haven't become incompatible with IBM software, and they can come back at any time, if IBM were to announce a revolutionary processor or software.

Giant Step Ahead

For the present, IBM seems to be happy as long as it stays a giant step ahead of the PCMs in terms of profits. But to meet IBM's own growth goals, Weil said it will have to do much better in the future.

"IBM is on a treadmill. It must get more sales each year or net profits go flat," Weil said, citing IBM's poor net profit showing in 1979 as an example. He predicted 1981 will be a relatively flat year followed by a sharp jump in 1982 with volume shipments of the 3081.

For 3033 users, Weil's predictions are reasonably good news. That means a 3033 is worth about 60% of its original price from Nov. 12 (the day of the 3081 announcement) until volume shipments of that processor in 1982. Then the residual value will dip to 40% of the original purchase price. The bottom of the 3033 market will drop out when the Sierra line appears on the market, in 1985. At that time the residual value will drop to 10%, according to Weil.

As for expanding into other areas, IBM has some tough decisions to make, Weil said. Desktop computers offer the most promising market for the next few years. But IBM hasn't made a strong showing in that area yet, and Weil said it may be too late. Other vendors, like Wang Laboratories, Inc., may already have a stranglehold on that market. Office automation type products are also hot, but IBM has been lagging there too, Weil said.

Distributed Processing

In distributed processing, IBM's 8100 has so far been a disappointment, Weil said, adding the unit offers too little main memory. Gartner Group's Crotty, however, said the 8100 will be expanded sometime next year.

In peripherals, Harvey says IBM is making them too small to fit the larger systems. The newest disk drive from IBM, the 3380, is only 2.5 times as fast as the 3350, a disk drive designed for the 370/148, which is about one-tenth as fast as the 3081 processor. IBM has got to do better, Harvey said, or it will be faced with some real problems in the future.

Users "will be stifled by I/O contention. You have to move the data one level closer to the instructions when you take a tenfold jump in processing speed," he said. "What used to be acceptable in high-speed disks now needs to be in virtual storage. What used to be acceptable in virtual storage now can't tolerate paging, and it must be resident in real storage. And, what used to be acceptable in the ultra-high-speed buffer, now has to be part of the instruction itself," Harvey noted.

Whatever the solution, the upper bound of the information processing industry is facing a revolution. The old ways just won't work anymore, and users are looking to IBM for the answer. Whether IBM will be able to meet that challenge remains to be seen.

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COMPUTER GRAPHICS COMES OF AGE

Computer graphics is receiving more and more attention throughout the industry from both business and technical professionals. During the '70s computer graphics was generally found on large, expensive, often dedicated, systems and only very selectively on smaller, less expensive systems. The early '80s will produce a revolution in which computer graphics will come of age and be available at lower costs for a broad range of general business and technical users.

Display graphics will be widely available on hobby, professional, desktop and minicomputer terminals, either built-in or optionally available at a nominal cost. Graphics input and output peripherals will be available at a price/performance ratio commensurate with that of the computer — for example, $1,000 for small plotters linked to professional and home computers and $20,000 for large, drafting-quality plotters on minicomputers.

In order to understand the impact computer graphics will have on the way we do our work, it is important to understand the broad application areas to which it applies: data display graphics, real-time display graphics and design graphics.

• **Data display graphics** is characterized by the term "chart graphics," which is the display of business and technical data in the form of a graph to facilitate interpretation and analysis. The use of graphs provides an excellent means of presenting numerical information on trends and relationships in a concise visual format to allow quick comprehension. Data may be displayed on a video screen or CRT or on a variety of hard-copy devices such as X-Y plotters, dot matrix and line printers, as well as via photographic hard-copy devices.

• **Real-time display graphics** is characterized by "pictures," and is frequently associated with modeling and simulation. It can be useful in both business and technical applications, although more examples of technical applications can be found. Although it is sometimes similar to data display graphics, it is dynamic and produces a new graphics presentation as conditions change or new data is received. Examples include process monitoring, flight simulation and radar/sonar tracking.

• **Design graphics** can best be described as the conceptualization, design and dimensioning of objects. It frequently involves computer-aided design/computer-aided manufacture (CAD/CAM) applications and is generally found in large manufacturing companies. The large concentrations of design graphics applications are in the areas of electrical design, mechanical design and architectural design.

While the application areas in each of these graphics market segments are quite different, they have one common attribute: the beneficial effects of graphics on both business and technical productivity. The strong interdependence of graphics and productivity improvement will be a central focus throughout the early '80s, fueling the development of the automated office and automated factory.

The power of graphics to improve the human/computer interface has led to a great deal of interest throughout the computer industry. According to several industry and business journals, computer graphics is one of the fastest growing markets in the industry. The sale of all graphics peripherals, software and systems is estimated to exceed $1.5 billion in 1980. The market itself is growing at a rate of more than 25% per year.

The power of visual information has been recognized since cavemen began drawing pictures on cave walls. Confucius' famous statement about a picture being worth a thousand words is taking on a dramatic significance today, as modern research on information processing and the human brain shows that a single picture can sometimes convey more than 1,000 pages of written material.

While computers may be ideally suited for an alphanumeric interface, a study of neuropsychology by Marvin Patterson, engineering manager at Hewlett-Packard Co., indicated that the human brain may more effectively utilize a graphical format. The two distinctive cognitive modes of the brain — symbolic sequential mode and graphical parallel mode — process information differently and make widely varying uses of the visual channel capacity. The symbolic mode — verbal and written language functions, mathematical skills and other operations that involve logical manipulations and interpretation of symbols — makes minimal use of the visual channel capacity. The graphics mode — the ability to recognize scenes, visualize special information and recognize patterns or interre-

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Hamilton is marketing manager, Desktop Computer Division, and chairman of the Graphics Task Force at Hewlett-Packard Co.

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By A. Peter Hamilton

lationships in graphical data — makes much better use of the visual channel capacity, allowing us to quickly ingest and analyze graphical data.

Research has shown, however, that an interface apparently exists between these two modes that may affect our interpretation of alphanumeric computer data. Once a mental visualization of a special object has been formed in our mind, for instance, reading a written description of that object can cause the visualization to be erased.

This may explain why we often find it so difficult to visualize trends, patterns and interrelationships when reading tabular, numeric data. Revealing the tabulated numbers to verify a possible pattern tends to further suppress any visualization that may have been formed. Presenting the same data in a line-graph format, however, makes trend and pattern information instantly understandable and sidesteps the interference problem.

It is the human ability to rapidly process visual information that makes graphics such an important computer interface, especially when the graphics system allows direct interaction with the computer. Interactive graphics allows computers to be used for determining the best presentation format for both business and technical data, as well as for specific design tasks, thus making it possible for the designer to visualize the format and then modify it. In business graphics, for example, a light pen or data tablet may be used interactively to develop the best presentation form — a bar chart, pie chart or trend graph — to emphasize the profile of the data in a form from which the reader can most easily extract the desired information.

Addition of the graphical data format for both input and output functions can provide major improvements in the efficiency of the human/computer interaction. An effective data format should make maximum use of the inherent data channels and mental processes.

The alphanumeric format, consisting of printed text or numeric tables, allows a data output rate of perhaps 50 word/min for a good typist and an input rate of about 200 to 350 word/min, with comprehension, for the average reader.

The estimated raw data capacity of the visual process is more than 40M word/min of information. Though alphanumerics may prove useful in some operations, this data display form uses only a small part of the visual channel's input capacity.

Any human problem-solving activity involves the need to analyze and communicate both symbolic and graphical data. The computer system that provides both data formats is better matched to the internal architecture and operation of the human brain than one that does not. In summary, then, computer graphics enhances the human/computer interface and speeds up the data comprehension process.

There are numerous graphics applications in business, but this article will discuss only three: decision support graphics, financial planning graphics and graphics presentations.

• **Decision support graphics.** Many companies are now finding that the periodic financial and operational data describing company or departmental performance can be more effectively and quickly presented via computer-generated graphics than tabular data.

Previously, information was presented as rows and columns of numbers in a stack of computer printouts. Occasionally, a manager might ask for a graph to be made, but this was infrequent because it had to be drawn manually or sent out to a commercial artist at considerable expense. Today, decision support graphics offers easy access to and analysis of data in just minutes. This method of management reporting and strategic analysis is becoming very popular because it allows executives to identify potential problems quickly without having to wade through volumes of numeric data and to perform calculations.

Decision support graphics allows managers to display data in the form most conducive to management requirements. It may, for instance, be used to show sales by sales region or by product type vs. quota. This allows management to quickly identify those regions that are over or under quota, or those that are successful with one product but not another. This data might be presented in bar-chart format, color-coded to highlight regional identity and product identity.

• **Financial planning graphics.** This form of graphics may involve econometric modeling, forecasting and historical data that can be displayed, manipulated and plotted to determine interdependence of variables. Better financial planning generally yields better financial results and graphics can greatly facilitate this process.

Financial planning graphics might be utilized to project product sales by year in a trend-graph form or order rate of change to show exceptionally fast or slow growth periods, or pie charts to indicate market share — perhaps in color to highlight the various competitors.

• **Graphics presentations.** This is the creation of visual presentations in a graphics form to aid the presenter in communicating to the audience. It may be by means of overhead transparencies or 35mm slides.

Graphics presentations can be created on a CRT terminal screen and interactively developed prior to being generated on a multicolor plotter, photographed by a variety of cameras directly from the CRT screen or copied via computer output cameras such as the Dunn or Matrix products.

It is important to realize that none of the above business applications requires a dedicated system to produce graphics output. In most cases, the existing computer system or a stand-alone terminal and hard-copy output device could produce the business graphics needed for decision support, financial planning or graphics presentation.

Small personal computers and desktop computers are also available with graphics capabilities for business applications. In some cases, the cost of these computers will be attractive for stand-alone, dedicated applications. In other cases, the cost will be such that graphics should be viewed simply as an integral part of a general-purpose processing capability.

Three of the most important technical applications in the use of graphics are process monitoring, measurement automation and CAD/CAM.

• **Process monitoring.** The importance of being able to display visually the process flow and to highlight the key elements in this flow has been recognized for some time. Graphics can increase the efficiency of monitoring and controlling process parameters by, for instance, highlighting over-limit conditions through video enhancements such as blinking. Graphics can be of enormous benefit in ensuring continuous operation of an expensive process facility and management of the process parameters for quality control.

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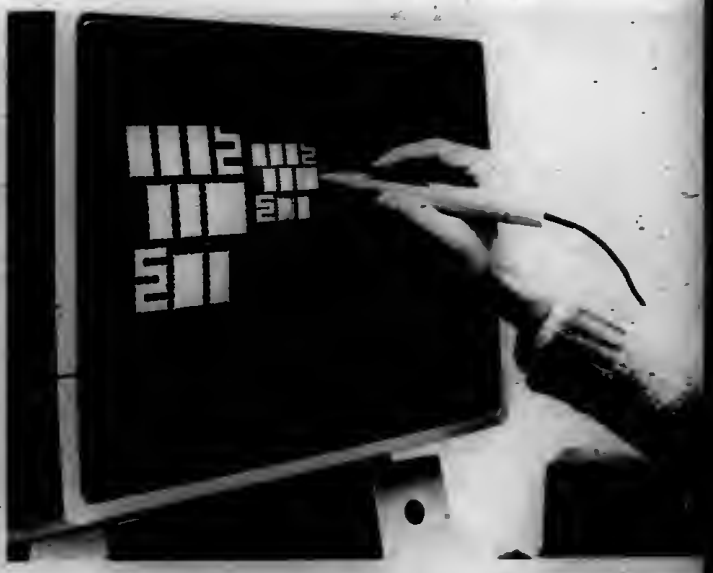

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• **Measurement automation.** Applications in this area include graphics display of a complex system being assembled or undergoing adjustment and calibration. In this example, graphics can highlight the area of the product to be adjusted, communicate with the operator and relate the step-by-step procedure as well as the current state of the adjustment relative to the correct set point. Automation of this type is found in aircraft and television assembly-test and a variety of other complex assemblies, as well as in the display of positional information in radar and sonar.

• **CAD/CAM.** Such applications, which involve conceptualization, design and dimensioning of an object interactively on a CRT terminal, require input devices such as light pens, data tablets and digitizers, and output devices such as plotters, printers and magnetic media.

An example of the use of CAD/CAM is the printed circuit (PC) board layouts required for electronic devices. PC boards may be designed on the CRT terminal, with components shown in the desired location and interconnections automatically routed for optimum circuit function and manufacturability.

In addition to full computer-aided design, sophisticated CAD/CAM systems are capable of performing design rule checks and providing machine-readable output suitable for manufacturing the finished PC board. This output is then utilized as input to the automated equipment to manufacture PC board blanks, drilling boards, performing the photolithography and even automating the loading of the components on the PC board.

Technical applications tend to demand more sophisticated and more expensive computer graphics capabilities than business applications. Dedicated CAD/CAM systems frequently cost $150,000 to $200,000. Although process monitoring systems are also frequently very expensive, the graphics display is a small part of this system cost. Process monitoring displays are available in the $2,000 to $3,000 range.

The cost of computer graphics is substantial, but without it many of the technical applications could either not be accomplished or would require highly skilled technical resources, a cost in labor that more than offsets the cost of the equipment.

State-of-the-Art Graphics

Graphics is virtually available on the entire range of computers, from personal and desktop computers to large mainframes. Graphics has perhaps had its greatest impact on the hobby computers, professional computers and desktop computers. Computers such as the Hewlett-Packard Co. HP 85, the Radio Shack TRS-80 and the Apple II, which range in price from less than $500 to $5,000, have provided computer graphics as an integral part of the system.

The user who in the past would have considered computer graphics beyond his or her budget and ability is given an opportunity to utilize graphics at a nominal incremental cost. These computers, programmed in Basic, emphasize a data display graphics capability and require minimal training to program.

Desktop computers such as the HP 9845 and the Tektronix Inc. 4050 have graphics built in. These systems, which cost from $5,000 to $25,000, provide sophisticated graphics for data display, real-time display and design. Desktop computers have displays from 12 in. to 19 in., pixel (smallest discernible picture element) resolution of 500 by 500 or 1,000 by 1,000 and are available in both monochromatic and color versions.

Graphics display speed becomes an important characteristic in these sys-

(Continued on Page 36)

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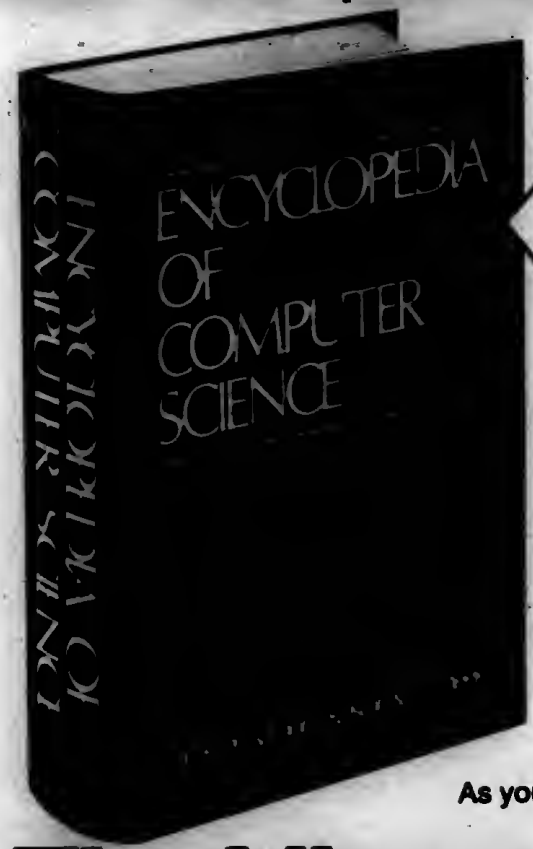

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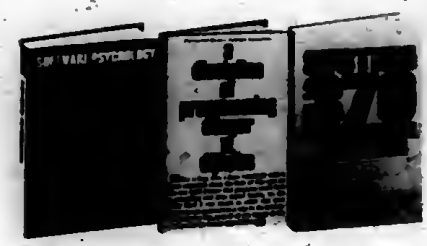

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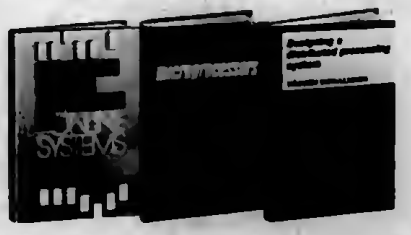

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tems. The ability to compute the direction, position and magnitude of the lines to create shapes requires a significant computational capability. And the ability to provide interactive graphics design requires high-performance displays capable of drawing 15,000 to 20,000 one-centimeter vector/sec. Display technology ranges from the direct view storage display with very high resolution and the lowest cost per pixel, to the more expensive raster displays that require memory for refreshing at 60 frame/sec and provide selective erase and the best interactive graphics capability with some sacrifice in resolution.

Broad Range

Users can choose from a broad range of terminals, some specialized for process monitoring or design graphics, from companies such as Ayden Controls, Inc., Evans and Sutherland Computer Corp., Sanders Associates, Inc., HP, Ramtek Corp., and Megatek Corp.

Many of these terminals have built-in microcomputers to handle display generation and manipulation. The terminals range in price from $2,000 to $50,000, and resolution varies from 500 by 500 to 2,000 by 2,000 pixels. The terminals generally use a high-level command language to facilitate the creation of the desired picture on the display and, in some cases, offer a full programming language such as Basic.

Typically, the terminals are dependent on a host computer for some significant portion of the application solution and can be characterized as either soft-copy output devices such as are found in process monitoring or interactive user interfaces as might be found in design engineering. Other devices include general-purpose business or technical terminals with an optional graphics capability.

Because an increasing number of computer users are aware of graphics as a powerful business and technical tool, most terminal vendors today are offering units with some graphics capability. The IBM 3279, for instance, offers high-quality alphanumeric and graphics and up to seven colors. Computer system vendors such as HP, Digital Equipment Corp. and the independent terminal manufacturers offer terminals with a wide variety of sophisticated graphics.

Historically, dedicated graphic systems have been very expensive and have been relegated to those tasks, such as CAD/CAM, that demand sophisticated computer graphics. The decreasing cost of computer hardware and the increasing availability of graphics on lower cost personal and desktop computers, however, have resulted in a number of dedicated systems for both business and technical applications.

Terminals connected to small minicomputers are capable of interactive business graphics, particularly in the decision support and financial planning areas. These systems range in price from around $5,000 to $70,000, depending upon software support and peripherals for graphics input and output.

I/O Devices

There are several important graphics input devices: light pens, which cost a few hundred dollars; data tablets, which cost $1,000 to $2,000; and digitizers, which range from $5,000 to $20,000. Each of these peripherals is designed for a particular type of graphics input: the light pen for picking and placing; the data tablet for drawing and digitizing where moderate resolution is acceptable; and the digitizer for precise digitizing of

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(Continued from Page 36)

graphics images.

Graphics output devices include electrostatic printers, ink plotters and computer photographic camera units. Whereas electrostatic and photographic devices are best for dumping complex graphics images, plotters, which range in price from $1,000 to more than $20,000, are best for data display and drafting-quality drawings.

Since there is a wide range of graphics components to choose from, the key to success is matching your application to the specific capability you need, and, wherever possible, choosing components which have been integrated and tested as a system.

Software is another major ingredient of successful computer graphics. Software tools, developed to facilitate the display of data in the desired form, are often extensions to one of the computer programming languages such as Basic, Fortran and Cobol. In some cases, dedicated applications software is available. For example, HP's Decision Support Graphics for the HP 3000 system gives the user an opportunity to access and graphically display data in the system without developing specialized programs.

Product Trends

• **High-quality graphics displays.** The heart of a graphics system is the display unit. Although direct-view storage tubes and stroke refresh systems will continue to dominate applications that require fast, high-resolution random writing, raster scan or digital television systems will be increasing their share rapidly from 30% in 1980 to 75% in 1983. This trend will be fueled by the decreasing cost of refresh memory and the associated decreasing cost of the display, along with increased interactive capabilities and color options.

Color displays today offer from 8 to 256 pure colors. The low-cost color systems are based on commercial color TV displays while the high-performance wide-color-range displays are based on more expensive CRT technology. The choice of which color display is a matter of application and budget. Color is available for as little as $300 and as much as $30,000 extra.

High-quality graphics displays are becoming prevalent. A typical computer graphics display has twice the resolution of the home TV set. The 1,000 by 1,000 pixel displays and even some 2,000 by 2,000 pixel displays are becoming available and fit the requirements for real-time display and engineering design applications. Better resolution translates into smoother lines.

• **Increased user interaction.** System interactiveness will be increasing, particularly for business graphics. We will begin to see a broader range of low-cost graphics input devices and the appropriate software to support them. This will result in friendly, interactive access to business and technical information for data display. Light pens and data tablets will be in the forefront of this interactiveness. Graphics data base management, a tool that will prove valuable for creating and storing graphics images, is also on the horizon. Data base management systems today are designed to support the organization and retrieval of alphanumeric data, but will need enhancement to adequately support graphics images. Such systems will probably be available on the larger computers initially, and then transported in a more efficient subset form to the smaller computers.

Applications software will become more readily available for both business and technical users. Today's business graphics software is oriented toward graphics output. In the near future, we will be seeing software that will better support the users' thought process and enable communication with the computer in terms of shapes and surfaces rather than data points

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NCE UPON A TIME, in a kingdom far away, there lived a hard-working merchant.

Usually, the merchant was the merriest of men, happy with his calling and ready with a smile for everyone he met. This day, however, found him trembling in fear at the edge of the Great Unknown Forest, a sack slung over his shoulder. You can imagine how his heart jumped when a voice behind him asked, "What do you have in your sack, merchant"?

Spinning around, the merchant saw a tall figure, with a flowing white beard and robes, and eyes that shone with both wisdom and kindness. "I have notices to the people of the kingdom," blurted out the merchant, "telling of all the goods I'll have on my wagon when I come to visit them in the spring."

"But why are you taking them through the Great Unknown Forest?" asked the tall stranger. The merchant answered hurriedly [illegible] has made a Royal Proclamation. From [illegible] notices to the kingdom will [illegible] to send, and they will [illegible] But are brought to the Royal Post Office on the other side of the Great Unknown Forest. That's where I'm going now, Sire. But I'm very afraid, for everyone knows there are many fearful monsters there."

"You need not be afraid," said the white-haired stranger softly. "I am a Sage, wise in the ways of the Great Unknown Forest. I know how to cross the Forest safely, and I can unlock the great riches to be found there. Come, merchant, I will guide you."

The merchant learned much that day. He learned that the Nine-Digit Zip Code Monster, while indeed quite unnerving on first acquaintance, might not be quite the horrible creature so many people said he was. He learned that the terrible Postal Carrier Route Monster wasn't going to entangle him hopelessly, as many said it would. It just wanted to get his notices to the villagers faster than ever, and for 20% fewer pennies than before. Most important, the merchant learned that, whenever he faced new address-matching and geocoding problems, the Sage could show him how to turn those terrible unknowns into profit-making opportunities.

From that day forward, the merchant was happy and prosperous. He married the king's beautiful daughter (didn't mention her?), and they lived happily for quite a while.

FORECAST 81

and vectors.

The user interface will be greatly enhanced through specialized keyboards, as well as new input and output devices. Graphics hard copy, particularly as it relates to color, will see some progress. The cost and availability of photographic hard copy will be improved in the interim until ink and laser hard-copy output are practical and competitive.

The price/performance of graphics systems will continue to improve at a rate better than the 20% to 30% cost decline in the computer industry. The decreasing cost of memory, CRT terminals and specialized firmware and hardware to support graphics will all contribute to this decrease in overall system cost.

The graphics workstation, consisting of a variety of graphics components designed to solve a particular type of business or technical graphics application, will see increased prominence. As the hardware and software vendors better understand graphics applications, they will configure and support graphics systems or workstations that are essentially "turn on and start solving problems graphically" systems. Graphics workstations are available today that include a terminal or desktop computer, graphics input device and plotter or other hard-copy device, and which can function as stand-alone systems or can be connected to host computers for expanded graphics system capabilities.

For the most part, what is needed to further expand the use of computer graphics is not fundamentally new technology but rather a practical, cost-effective implementation of existing technology.

In the case of displays, for instance, the increasing volume requirement for high-performance, high-resolution color units will dramatically reduce their cost and increase their widespread availability. Ink-jet technology, driven by the demand to achieve lower cost in volume production where widespread use would be reasonable, is slowly making its entry into the computer graphics hard-copy arena. Memory prices are continuing to decline, which will directly benefit computer graphics applications because many of these are data base and memory intensive. Winchester disk technology is important for these same reasons, and high-density, lower cost disks are rapidly becoming available and will facilitate the growing demand for computer graphics. Specialized processors, graphics processors and other large-scale integration devices for enhancing the overall performance of computer graphics will receive a great deal of emphasis. I/O devices, based on laser technology, will permit real-time visualization of computer output as the input data is actually processed.

Perhaps the biggest single technological obstacle to the increased use of computer graphics is the lack of appropriate software engineering. Software developers and computer vendors are, however, increasing their effort to provide the basic tools necessary for faster programming of user applications incorporating graphics.

In short then, over the next year or two, we can look forward to an increasing use of computer graphics in both the business and technical areas. Supported by dramatic decreases in computer and graphics I/O costs and increasing productivity demands, computer graphics will offer users an easy-to-use, cost-effective interface to their computer applications. The end result will be a faster, more effective way of presenting, analyzing and understanding the data upon which both technical and business users depend.

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FORECAST-81

By Ann Dooley

USER BUDGETS: UP, UP, UP

Overall Budget	Up 12%
Salaries	Up 13.1%
Communications:	
Line Charges	Up 28.4%
Terminals	Up 37.6%
Packaged Software:	
Systems and Utilities	Up 18%
Applications	Up 18.4%
Minicomputers	Up 25.6%
Mainframes	Up 11.8%
Peripherals	Up 12.2%
Maintenance	Up 8.4%

They're in charge of machines, but they worry about people.

Managers report an astounding 45.6% of data processing budgets is being swallowed up by employee salaries on the average — a figure that warrants concern. What's more, spending for salaries will rise another 13.1% during 1981.

Responding to *Computerworld's* annual budget survey, 45 top computer executives from around the country reported that spiraling people costs and retaining qualified people are their biggest headaches.

Overall, DP budgets are expected to rise an average 12% in 1981, the computer executives told CW. As many as 71.1% of the users in the survey are planning to increase their budgets next year, while 17.8% plan to hold budgets at 1980 spending levels. The remainder were either unclear or unsure of what their next year's budget increase would be.

But in almost all cases, the department heads indicated a cost consciousness that few in DP have had to contend with until recently.

Increased productivity was uppermost in the managers' minds, no matter how large of a budget increase was anticipated. Methods to achieve this varied among the respondents — some planned to hold the line on equipment purchases or employee hiring, while others plan to automate labor-intensive jobs more extensively or implement software packages aimed at increasing programmer productivity or moving work to the end-user departments (see story on Page 44).

As Willi Hartung, manager of information systems at Central Maine Power Co., stated, "Our main concern is to keep step with inflation by improving productivity without raising costs. More for less sums it up."

Labor-intensive areas of the budget like data entry are being sliced. On the average, user reported data entry spending will actually decrease next year by 1.5%. As many as 26.7% of the users surveyed are cutting their data entry spending, while 48.9% are planning to hold the line of spending in this age of inflation. Only 8.9% of the respondents will be increasing their data entry spending.

Most of the cuts are being accomplished by changing to on-line applications, adding terminals and dropping people and switching to a remote job entry environment, survey results showed.

Salary costs rose steadily among all the users surveyed, unlike some equipment categories which were affected by specific purchases of high-cost items.

The lowest salary apportionment was made by a Billings, Mont., DP director who allotted only 25% of his budget to salaries. At the highest point, salaries totaled 70% of the computer budget, for Donald Steel, director of information services at Tobin Packing Co., Albany, N.Y.

Nearly 60% of the users surveyed indicated salaries alone constituted more than half of their entire budget plans for next year. And one user who currently spends 35% of his budget on salaries plans to increase his salary allotment by 40% in 1981.

Most respondents plan to distribute the salary increases equally among all personnel categories. Of the 10 managers who indicated they were differentiating among the personnel types, programmers were seen to be receiving the highest raises, followed by systems analysts, managers, operators, and lastly, data entry personnel.

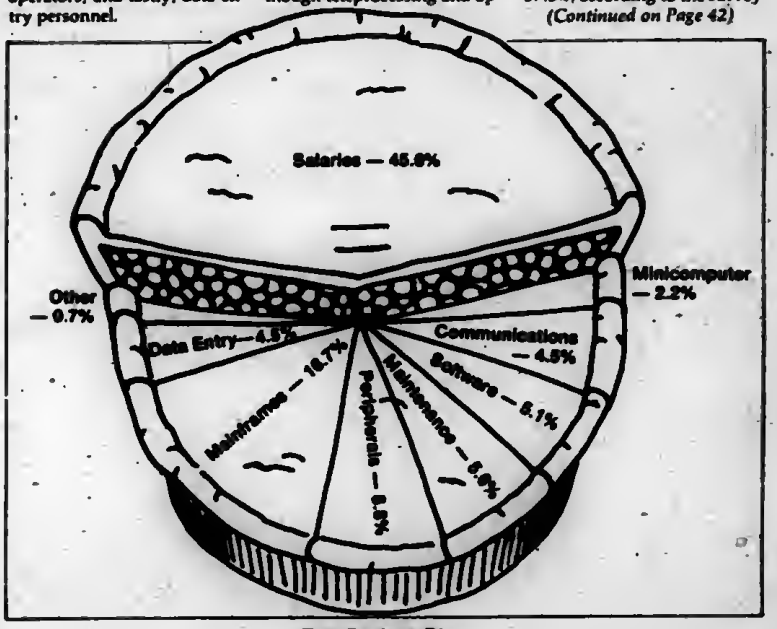
Surprisingly, more than half the managers do not plan to create new positions in their departments in 1981. Among 44 respondents, 54.5% have no plans to add new personnel, while 44.4% said they would add an average of seven new positions over the next 12-month period. Although many users plan on hiring four or five new people, one California clothing manufacturer plans to hire 50 new people as a result of new operations at his shop.

The new positions were overwhelmingly for systems analysts and programmers, although teleprocessing and operations positions were also in the offing.

Users reported that communications costs will increase more than any other budgetary item over the next year. Although communications comprises only a small portion of the overall budget, according to those surveyed, the high increases reported by the respondents for 1981 can frequently be attributed to specific purchases by individual users.

Communication line costs were reported to be rising 28.4% on the average and terminal costs will be increasing 37.6%, according to the survey

(Continued on Page 42)



The Budget Pie

The Computerworld annual budget survey was conducted by staff writers Ann Dooley, Bruce Hoard and Marguerite Zientara.

(Continued from Page 41)
results. This figure varied from a DP director in a western distribution firm who was reducing his communication costs by 40% next year, to a Washington state user who is increasing his costs by 200%. In his and in most other cases where high increases were reported, users indicated they were converting to on-line systems or distributed data processing (DDP) environments.

Software was another inflationary item in users' budget plans for 1981. When broken down by area, the survey showed that spending for systems and utilities packages will increase by 18%. Among those surveyed, 42.2% will be increasing their systems and utilities packages spending and 3.1% will be holding even.

Respondents reported an average 16.4% increase in spending for applications packages, and outlays for data base management systems — which drew a much smaller number of user responses — will increase an average of 6.2%.

Mini Outlays

Allotments for minicomputers will rise 25.6% in 1981, if the survey respondents utilizing minis are correct. Although a number of users are planning to obtain minis for the first time next year or will be expanding their usage, as many as 44% of those surveyed made either no significant use of minicomputers or had none at all.

The minis in use were reported to be functioning primarily in specific applications pertaining to an industry, such as electronic funds transfer applications in banks or instruction in schools. Other common uses included remote control processing, DDP, business functions, telecommunications and data entry.

In the system end of the budget, overall mainframe spending will increase 11.6%, according to the users surveyed. Approximately 44% will be increasing their mainframe expenditures in 1981, while 35.5% of the users plan to maintain spending at this year's levels and 8.8% reported cuts in spending. Those reporting reductions in mainframe costs attribute the phenomenon primarily to completion of equipment purchase.

IBM clearly came out ahead in mainframe selection for next year. Of the one-third who indicated they plan to purchase new systems, the most commonly mentioned purchase was an IBM 3033 (five purchases) followed by two purchases each of IBM's 3033N and 4341 systems and one IBM 370/148. Other mainframe purchases include a Hewlett-Packard Co. 300 system and a Burroughs Corp. B3700 and B3800 system.

In the area of peripherals, overall spending will increase by an average 12.2%. More than 42.2% of the respondents plan to maintain similar spending habits to 1980. Increases in spending for peripherals were indicated by 37.8% of the users while Cecil Patterson, director of systems and DP for the Port of Seattle, indicated he was decreasing his peripheral expenses. Patterson is also planning to decrease spending for systems and maintenance by implementing a distributed system.

An area that will experience a 7.8% average increase will be maintenance. Approximately 44% of the managers will be increasing their maintenance costs, 26.6% will stay at this year's level and 11.1% are planning to decrease their maintenance costs over the 12-month period.

Supplies — traditionally an area of cost contention among users — will again be going up, this time by an average of 8.4%, according to the computer executives polled. Citing paper and forms as the primary contributor to inflation, 60% of the users indicated their costs would be increasing in 1981. Nearly 25% report they will remain at 1980 spending levels for their supplies and 2.2% report they will be reducing their supply costs.

Those users who reported being able to hold level or reduce costs, most often attributed this achievement to "getting away from paper" by using more terminals and microfiche. Some plan to curtail their customized forms usage or switch to using both sides

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FORECAST '81

of a form or adding to their lines-per-page ratio.

Although the managers polled did not predict salaries to be the highest rising cost in 1981, they ranked it as the most inflationary item in 1980. This may be a warning that keeping salary costs down may be an unrealistic expectation, given the anticipated rate of inflation and the need to remain competitive in the face of a high turnover rate expected throughout the year.

Departing from budget concerns, respondents mentioned some other worries for the upcoming year — and the Number 1 problem was retaining personnel (see story on Page 45).

System development and conversion problems and the ability to keep operations running was the second most mentioned concern among users. Long-range planning for system purchases, software applications and company growth paths were also ranked high by many of the executives. "We need to take time to plan our systems. We're running as fast as we can to fulfill user needs but we need an overall plan for the department and the company," one San Francisco bay area manufacturer's vice-president of information services stated.

Other concerns on the minds of users were programmer productivity, customer support, department reorganization, DDP implementations, holding down costs, work load and the availability of system uptime.

WP Function

The computer executives reported that even though the word processing (WP) function in most companies was spread through several departments, the WP function came under the aegis of the data processing or information processing manager.

While 11.1% of the companies surveyed had no word processing system as yet, of those that do, 75.6% of the computer executives were either directly responsible for selecting WP equipment or instrumental in the decision. Only 13.3% of those with word processing in the company played no part in its selection, according to the survey.

In examining how their department's budgets related to the general economy, 60% of the respondents said they had been virtually unaffected by the recession. Only 28.8% said their departments' spending was affected. Of those, most cited delays or cuts in work projects as the result. Others indicated that their ordering patterns had been affected; they were forced to hold off buying new equipment or offer lower salary increases. But one happy vice-president at a Houston bank exclaimed, "No one knows there's a recession in Texas."

IBM proved to be the predominant vendor among the respondents with 71% using IBM mainframes.

The respondents worked in all parts of the country and represented a cross-section of shop sizes and a broad range of industries, including manufacturing, retail, service, educational and insurance. DP budgets ranged in size from $300,000 to $43 million among those surveyed.

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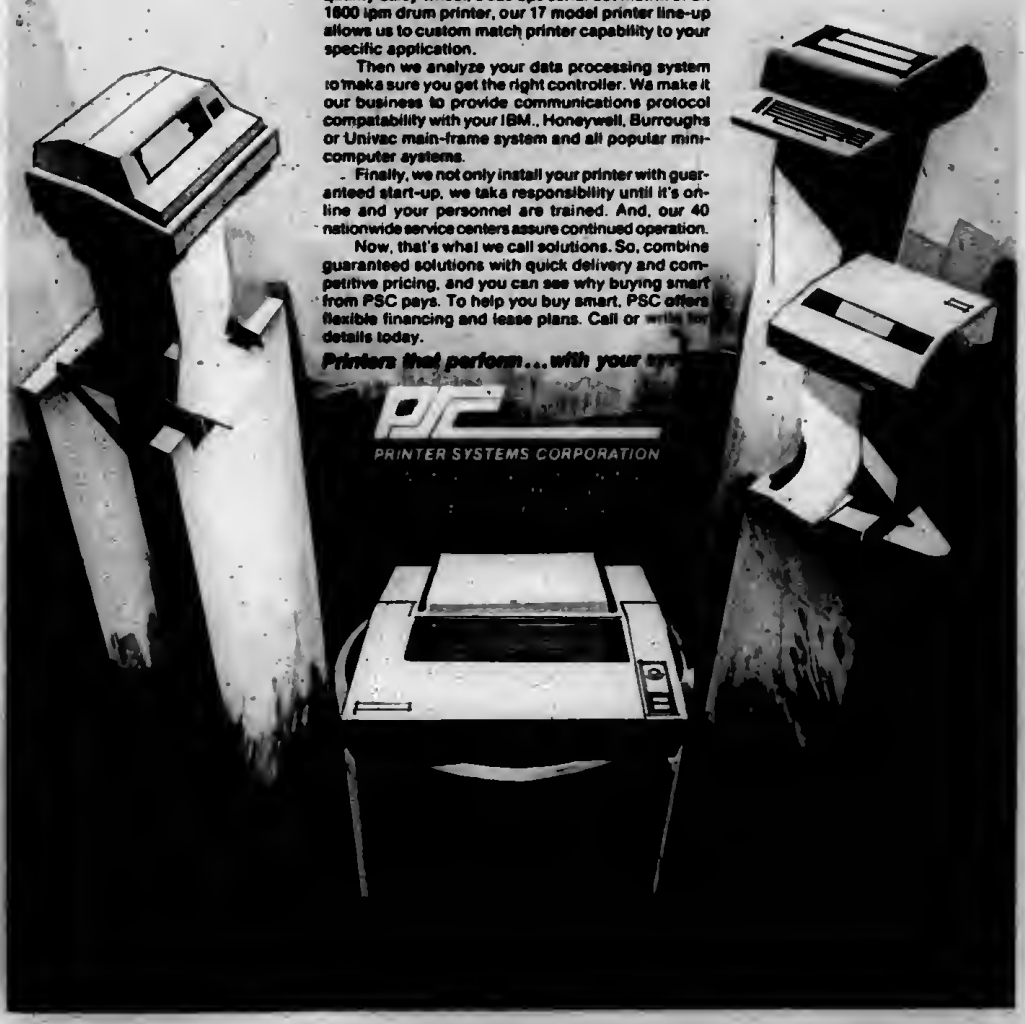

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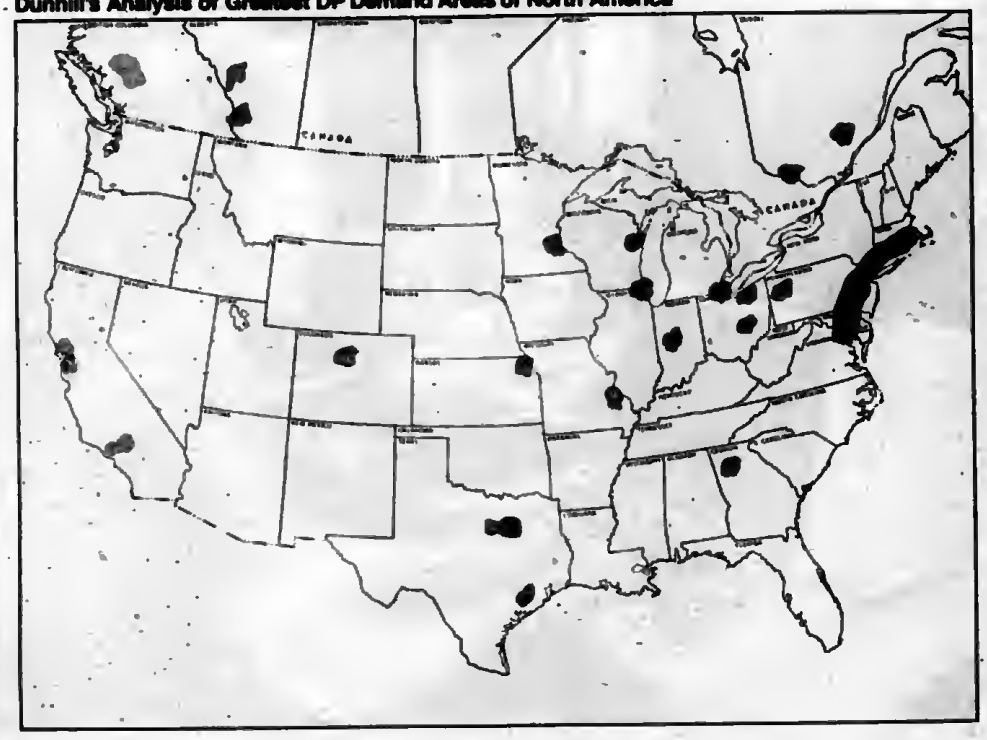
FORECAST '81

By Don DeCamp

EMPLOYMENT: THE '81 OUTLOOK

Dunhill's Analysis of Greatest DP Demand Areas of North America*



The employment forecast for computer-related professions should come as no surprise to anyone who has been keeping pace with the industry's outstanding growth and concomitant labor shortages. The prognosis is, simply, more of what we experienced in 1980.

There will be an ever-increasing demand for virtually anyone with any type of DP skill (despite the fact that serious inflation and a general business slowdown will force cutbacks in almost every other non-DP, white-collar job category). This demand will be coupled with an increasingly serious shortage of qualified, experienced DP personnel. The high demand/serious shortage complaint will be most acute for DP people with backgrounds in applications or software development.

What may come as a surprise to some are the figures. One government report estimates that during the next decade, personnel shortages within the industry as a whole will approach 20% compounded per year.

Readings taken throughout the industry by Dunhill/DP (a DP recruiting network in North America) indicate the possibility of a 20% shortfall for systems programmers during 1981 and a 40% shortfall for applications people. A nationwide survey Dunhill conducted this month among 20 top metro markets revealed that companies across the board plan to increase their hiring in 1981 by anywhere from 10% to 40%.

U.S. Department of Labor statistics confirm the serious nature of the shortages. Jobs for computer professionals are expected to increase nearly 84% by 1990, more than four times the projected rate of growth for all occupations in the country.

The Labor Department projects that there will be a 154% increase in jobs for computer service technicians, 119% for systems analysts, 116% for computer and peripheral operators and 102% for programmers. Only jobs for keypunch operators are expected to decrease by 16%, and this decline is really attributable to technological advances.

Perhaps the most interesting aspect of these Labor Department projections is that they fail to forecast employment trends for any computer-related job categories other than the ones mentioned above. Extrapolating from the 1970 census, there was no way of predicting the tremendous variety of DP job categories that would be created by the incipient technological revolution.

The past few years have seen the emergence of an era of processed information whose ultimate course has not yet been charted. Computers literally interface with almost every aspect of business, industry and government and are beginning to have a profound impact on individuals as well.

As a result, job descriptions unheard of in 1970 have become commonplace in 10 short years.

But if the Information Age was in its infancy in 1970, by 1980 the levels of technology and capability have become so sophisticated that user demands for the byproducts of this revolution far surpass the industry's resources to meet them. This intensifying user demand is one of the key reasons for the industry's current personnel shortages. Major institutions such as banks and insurance companies have traditionally been large consumers of computer technology, but there has been a recent rapid increase in the number and availability of small business systems whose future impact and potential effects on the country's economic development are just now being realized.

The development of prepackaged or mass-market-type programs that can be customized to meet specific in-house needs are creating new applications for computer technology at an astounding rate. By 1990, automated offices and offices connected by complex computer-controlled telecommunications networks will be commonplace. Home computers will create another strong user demand area over the next few years.

Proliferating user demand explains why the most serious current need for DP professionals lies in the applications end of the industry. Companies across North America report that the shortages that most paralyze their ability to harness computer technology are for applications programmers, programmer analysts and systems analysts, particularly those with between three and five years of experience.

Many executives have said that they have committed time, resources and large sums of money to projects that must be brought to completion, but which are currently stymied for lack of an adequate work force. In the past, these managers would have relied on new technology to compensate for limited staff. This may not be the case in 1981, when we may see fewer major technological developments on the horizon to relieve the pressures created by personnel shortages. In most companies, seven people will be doing the work of 10.

There is an equally serious shortage of technical support people. This technical shortage has been caused in part by newly created positions, but also by the rapidly increasing number of small systems houses and software suppliers, which are attracting some of the most experienced and innovative talent in the industry. Many DP professionals said that the opportunity for personal development and for keeping knowledge at the state of the art are far greater within a small systems house than a large company. A common problem for the highly motivated DP professional who participates in the implementation of a system on the corporate level, is that, once the system has been established, maintenance is often routine. At this point, with so many other opportunities available, many professionals opt for a more challenging position elsewhere.

The professional shortage is compounded by several factors. Universities are not graduating enough new talent and educators are not encouraged to remain within the university environment since they can often earn more in a corporation or software house than they can as a full professor. Secondly, people are not being attracted to the profession in the numbers calculated to sustain its development, a fact that many attribute to the lack of a so-called family tradition that is characteristic of the medical and legal professions. And lastly, those who do receive some form of technical education frequently lack the business background that will enable them to effectively apply their newly acquired

(Continued on Page 46)

DeCamp is national EDP recruiting director for Dunhill Personnel System, Inc.

FORECAST-81

By Marguerite Zientara

COPING WITH STAFF TURNOVER

Photo by Quinta Scott

Imagination and resourcefulness may be the keys to acquiring and retaining skilled DP personnel in these days of technical manpower shortages.

In a recent telephone survey, 37 out of 45 DP managers interviewed said they had problems finding skilled workers in the technical area. Such shortages — besides taxing the creativity of employers — are resulting in lost project time, high turnover rates and very expensive talent for information processing managers around the country.

Some say the root of the problem is the American educational system, which continues to churn out millions of fine arts and liberal arts college graduates yearly in the face of diminishing demand for those fields. But whatever the cause or causes, it is The Cure that interests management, and that seems to lie in intelligent planning based on realistic manning expectations. Companies have to stop basing their plans on recruiting and retention levels that were never attained in past years, experts are advising.

In *Computerworld's* recent survey of recruitment problems and solutions — which was a subset of CW's annual budget survey (see story on Page 41) — not only did 82% of the respondents indicate they had problems getting skilled DP personnel, but 27 of the respondents, or 60%, said they had hired personnel without DP expertise or experience.

While a handful of those hiring people without DP backgrounds for DP jobs indicated the hirees were from other departments within the company or were hired only for clerical or operations positions, others specified they hired college graduates in business, math or other areas, for training as programmers or programmer analysts.

In all cases but one, managers indicated they were pleased with the results and that those workers proved effective, overall. The dissenting viewpoint came from a manager who indicated their effectiveness was "50-50" and he preferred "not to do it."

Others, however, have taken some novel approahces to the hiring of non-DP personnel for DP jobs. One midwestern manufacturing firm's DP department has instituted a "doubling part-time experiment" in which two part-time workers are hired for one full-time job. Not only is the situation ideal for "women raising families," the DP manager indicated, but "we expect to end up with full-time workers."

One firm's experience with hiring non-DPers extended only to bringing on-board a former factory supervisor, who proved to be effective. While that exemplifies some managers' reluctance to hire the nontechnical, David Henry, DP manager for the New Orleans food manufacturer W.B. Reilly & Co., has hired such people as manual laborers, stockmen and mailboys as operators and keypunchers.

Have they proven to be company assets? Yes, according to Henry, and furthermore, "They are loyal to the company."

One recruiter, however, in a separate interview, offered a bit of bad news regarding the hiring of college graduates with nontechnical degrees. Based on a study done by his company, Ed Haynes, employment manager for Texas Instruments, Inc. in Dallas, found the turnover rate among DP workers with "strange and flaky degrees" is three times the rate for those with computer science degrees.

"I don't know whether it's because those people tend to move around a lot, or because people without technical degrees are offered less money than technical people for the same jobs," Haynes said.

As an example, he estimated that an engineering graduate from a northeastern university, who majored in computer science, would earn a starting salary of $22,000 as of December 1980, while a business college or university graduate who majored in DP management would be offered $18,500 to $19,000 to start the same job.

The reason boils down to supply and demand, he noted. "There are just fewer graduates with that computer science degree; in fact, looking for a software engineer is like tracking an endangered species," Haynes added.

Calling the liberal arts college mill "one of the major areas of consumer fraud in the country today," Haynes cited a recent report of the College Placement Council, "Inflation and the College Graduate," which found that the real dollar value of the fine arts and liberal arts educational experience has gone down at a rate almost twice as fast as any other academ · major in the last 17 years.

That group also found, in its 1979 annual salary survey, that 60% of the job offers made to the 1979 graduating class went to engineering graduates, who comprised only 6% of the entire class. When the offers that went to business and natural science majors are added to that figure, all the rest of the graduates, 68%, were left vying for only 6% of the positions being offered through on-campus recruiting, according to the council.

Whether or not the American educational system can rightfully be blamed for the shortage being so acutely felt in the industry, the ramifications thereof seem to touch several of a DP shop's facts of life.

In the area of personnel turnover, 12 out of 45 respondents to the CW survey (26.7%) said their turnover rates had increased over the last two years.

"Our turnover rate has increased a little, excluding layoffs, because the headhunters are busy and are stirring things up," one midwestern freight company's vice-president of information services said.

"The shortage of people is typical of the industry," he continued. "People move around a lot; things are getting tighter as the years go by, so there'll be more turnover."

For the DP manager of an Eastern seaboard manufacturing conglomerate, which has gone from manual to automated data processing just in the last year, "The biggest problem in the DP industry today is maintaining salaries internally; they can always get more money elsewhere."

At a Kentucky coal mining enterprise, the operations manager noted that, while its turnover rate in DP has increased generally in the last two years, the rate has decreased in the last year. "The economy is the reason for this year's lack of turnover," he felt.

And while some managers' turnover rates have increased, almost as many — 10 of those interviewed, or 22% — indicated their turnover rates have decreased in the same period.

(Continued on Page 47)

Zientara is a writer/analyst at CW.

(Continued from Page 44)

knowledge in a meaningful context.

All of these factors are contributing to two trends that we expect to see with increasing frequency throughout 1981. One is the development of highly sophisticated in-house training programs through which companies can smooth over technical gaps and reeducate DP staff to new systems.

In-house training may become an absolute necessity in 1981. The shortages in the DP arena are so acute that companies are more concerned with a person's capability to learn than they are with specific knowledge of language or hardware.

In addition to filling such knowledge gaps, well-designed and carefully run training programs have the added benefit of keeping staff up to the state of the art. This enables employees to continually upgrade their skills and can be a morale and incentive booster for an individual to remain with the company.

The second trend is the evolution of the contract programmer, in effect a form of office temporary, who works for companies on a project-by-project basis. The contract programmer will be utilized much more in 1981. With the development of more small business systems, many companies will not have the need for a full-time DP staffer, but may simply require someone to adapt a system and handle the start-up. Companies who do need full-time programmers frequently can not locate them.

As a result of both these factors, more and more programmers will begin to work on a limited contract basis, handling specific assignments for a prearranged period of time. This may be mutually advantageous to both company and programmer, who find that they can solidify their working relationships as a result of this "getting-to-know-one-another" period.

For programmers, working on a contractual basis has the added benefit of increased mobility, allowing them to investigate a new geographic locale for several months before making the decision to relocate.

Although there is much talk in the industry about software shortages, a serious scarcity of qualified personnel is literally embracing every phase of the industry and is acute in the hardware sector as well. Demand for mainframes and minicomputers is expected to remain strong and steady, but perhaps the greatest area of potential growth in 1981 will be in microprocessors.

Microprocessors have application in just about every phase of the computer industry, but will be particularly vital to the development of small business systems, home computers and the electronic gadgets of every sort that are gaining popularity among consumers.

Personnel shortages are fairly well distributed by industry and by geographic locale.

Perhaps the greatest demand for user-oriented DP professionals in 1981 will be in the services industry. In fact, the U.S. Department of Labor predicted a 109% increase in the number of computer professionals employed in this

(Continued on Page 48)

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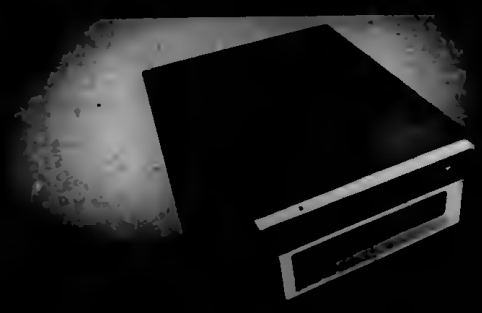

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FORECAST '81

(Continued from Page 45)

"I'm a heck of a nice guy to work for," the DP director of an Eastern heavy equipment distributor said, echoing the sentiments of several respondents who observed that workers stayed with companies where they were treated with respect and offered liberal benefits.

The overwhelming percentage of respondents — 48.9%, or 22 people — indicated their turnover rates had stayed the same in the last two years. Five of the 22 said they had no turnover in that time, although the figure may actually be higher, since some interviewees may not have felt it necessary to answer beyond saying the rate was the same.

"We keep our people happy with profit-sharing, a stock purchase plan, discount vacation plan, good salaries and good fringe benefits," noted Bill Sanders, vice-president of information services at Tri-State Motor Transit of Joplin, Mo., one of those with no turnover at all.

Another shop, with 16 workers, has had no turnover in four years. "I like to think it's a good shop," remarked David Henry of W.B. Reilly & Co. in New Orleans. Furthermore, when Henry needs new personnel, he relies on "word of mouth — that's usually all it takes."

One shop that has had no turnover "other than data preparation" in the last two years finds a problem in its "Brand X equipment — NCR Corp. or Burroughs Corp. — as opposed to IBM," according to Robert Chouinard, DP Director at Ryans, Inc., a wholesale grocery distributor in Billings, Mont.

The firm, whose newly acquired parent company is effecting a switch from NCR to Burroughs equipment, "can't find people skilled in our equipment," Chouinard complained.

New Hires

The stated difficulty in finding skilled personnel notwithstanding, 30 of the 45 respondents (66.6%) indicated they filled all their new hire positions last year. Ten people (22%) did not fill those positions, and five interviewees (11%) had none to fill.

Whether or not they were successful in filling their new hire positions, most managers cited traditional recruitment methods as those on which they had relied; newspaper advertising, search firms, referrals, internal employees, personnel agencies, walk-ins, DP schools and local colleges.

Among those who were successful in filling openings, there were two noteworthy exceptions to the conventional recruitment techniques. Lady Luck smiled on Jack Laubach, vice-president of information services at Scot Lad Foods in Lansing, Ill., when the nearby Wisconsin Steel Corp. closed down last summer.

"They had an exceptionally large staff who were very well qualified," he observed, enabling Laubach to choose from a stable of willing and able experts.

In Augusta, Me., a remote geographic location, Willi Hartung, manager of information systems for Central Maine Power Co., was able to take advantage of a progressive state program for the handicapped to fulfill some of his personnel needs.

"A major help was the Bureau of Rehabilitation's program to turn handicapped people into productive citizens," Hartung said. "We hired three programmer analysts through that program and are very happy with them."

The "heck of a nice guy to work for" mentioned above also managed to fill all his new hire positions last year. Said he, "I have more people call-

(Continued on Page 48)

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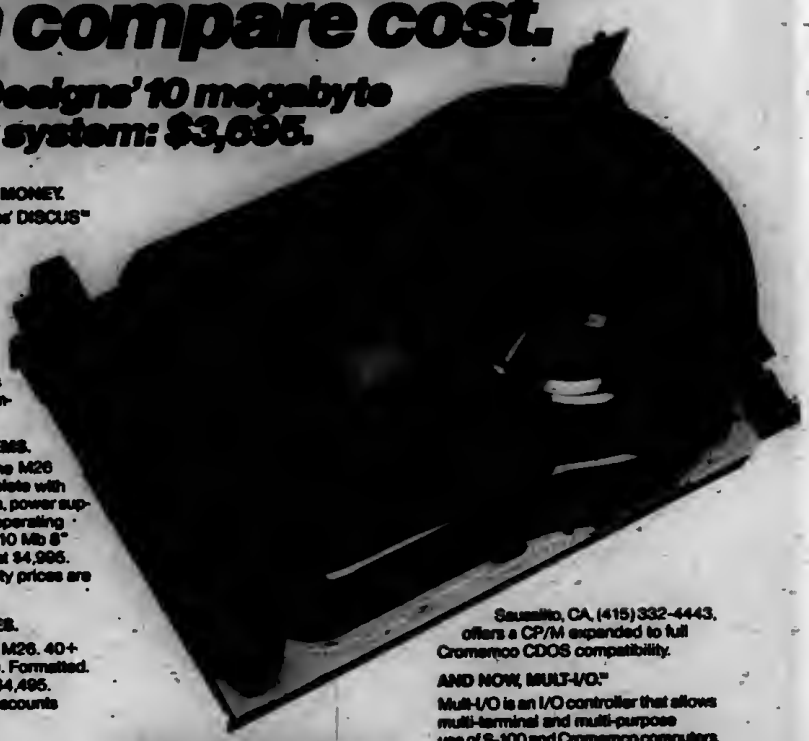

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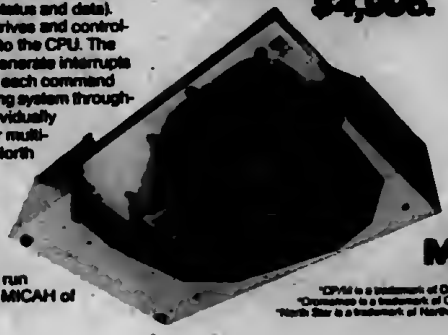

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(Continued from Page 47)
ing me and sending me resumes than I'll ever use."

Just because most managers did fill their openings last year, that does not mean it was always effortless. While J.H. Lowe, information systems director for A.C. Transit Co. in Oakland, Calif., filled his quota, "It took some time," he noted, as well as "every [recruitment method] that's known to man."

One manager who filled all his new positions last year said he may nevertheless initiate a program for giving employees bonuses if they find new programmers.

Of the 10 who were not able to fill their new hire positions last year, three indicated the lack of skilled people resulted in delayed implementation of projects. As one manager put it, "We were scrambling all year." Three others of the 10 who lacked workers indicated some projects just didn't get done at all. Four of the 10 who did not fill their positions said the situation did not adversely affect any long- or short-term projects.

Six of the 10 without their needed new hires said they would not try any new recruitment methods in the future.

Employment: The '80 Outlook

(Continued from Page 46)
arena over the next decade.

We should also see an extremely high demand for DP professionals in the energy industry, currently one of the country's fastest growing business segments. The Labor Department projects an 89.9% increase in DP jobs in oil companies and mining firms, as well as in companies involved with the search for alternate energy sources.

City, state and federal governments will also provide an ever-increasing number of jobs for DP professionals (up by an estimated 77.8% by 1990), as will financial, real estate and insurance firms (up 75% by 1990), manufacturing companies (up 72.5%), construction (up 71.6%) and wholesale and retail companies (up 70.8%).

Demand for Auditors

Companies in every industry are reporting an across-the-board need for financial auditors with a DP background as a direct result of the ever-changing economy.

The DP audit may well be one of the main resources companies will have over the next several years to monitor cash flow and to hold a line on costs.

In fact, the advent of the computer has provided financial executives with a valuable tool for economic forecasting, which aids in such critical processes as corporate mergers and acquisitions.

Despite this trend, many managers report that they rarely see DP people with any accounting or auditing experience, nor do they see financial personnel with DP training. Employees who combine both skills are at a premium.

Geographically, the demand for computer professionals is fairly strong in virtually every region of the country.

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FORECAST 81

By John A. Murphy

MERGING WORD AND DATA PROCESSING:

A FIRST STEP TOWARD TOTAL INFORMATION INTEGRATION

While tomorrow's corporate information needs will be supported by fully integrated electronic systems that provide for voice and data communications as well as electronic mail and voice and data processing, we are not there yet. Today, users are taking their first steps toward that goal by beginning to integrate word and data processing.

Just what is implied by the "integration" of word processing (WP) and DP is difficult to define. As with other concepts popularized in the industry by catchy buzzword phrases, integration has connotations unique to particular situations or systems. Users and vendors view the concept within the context of their own immediate needs, desires or fears, coupling performance and operational requirements with economic and political considerations.

DPers have flirted with word processing and a form of integration since the early days of interactive or time-shared processing. WP was viewed just like any other application and was usually subordinate to most DP jobs. Implementation tended towards the text editing and formatting of large, multipage documents or reports with little emphasis placed on the handling of the more mundane correspondence common to office operations.

DP manufacturers, if they considered WP at all, would usually bundle it into some large, centralized system. Hardware and software interfaces were the same as those applied to DP operations. Users had to possess DP-level skills to implement WP, and little attention was given to extending such functions to office personnel.

Murphy is executive editor of Data Decisions, Inc. in Cherry Hill, N.J.

Such attitudes still persist in present-day DPer views on WP. Managers burdened with line responsibility for DP have little inclination or time to consider the value of WP to overall operations. Some pay lip service to the importance of integration, while others hope that the whole idea will just fade away. Most consider that if integration must be accomplished, WP should fall under the auspices of the DP department and not be treated as an equal.

WPers at first did not consider DP or the implications of integration. They were enmeshed in selling the then-new WP concept to a conservative office management. Indeed, the mention of data processing or computers in relation to word processing was taboo. The use of these terms was avoided to allay any fears of managers or typists intimidated by such equipment. WP manufacturers coming from a similar office equipment environment and marketing to this conservative group also totally neglected data processing in their word processor designs.

Some present day WPers are also apprehensive about DP and the implications of integration. This time fear is expressed from the professional ranks of WP managers or supervisors. They feel DP, with its enormous budgets and close proximity to corporate power centers, will totally control WP to their and the user's detriment. These fears, coupled with the DPer's attitude that WP is a somewhat unsophisticated adjunct to DP, has placed a barrier between the two professional groups most involved with eventual integration.

While political differences divide WP and DP professionals, the manufacturers, as represented by their equipment, have come closer together in integration under the impetus of converging technologies. The rush to capitalize on such concepts as "distributed processing," "personal computers," "the electronic office" and so forth has flooded the market with products attuned to both word and data processing. Many of the DP systems coming on the market offer WP as an application package. Some of the more advanced WP systems introduced recently at least have compiler-oriented DP capability. DP, in expanding downwards to smaller or dispersed systems, has begun to address the needs of the office market. In a similar manner, WP, in expanding upwards to larger shared-resource systems, has begun to market products with the power to perform DP.

Specific embodiments of the integration concept also incorporate certain components of message or document communications and storage/retrieval. Again, depending on the integrator, such capability may be considered part of the DP or WP scheme of things or may be lumped under the electronic office concept of information processing. The following outlines some approaches taken toward integration by some of the off-the-shelf systems now on the market.

- **IBM/DPD 3730:** This multiterminal system is an enhancement of the older 3790 distributed data processor. Like the 3790, the integrated system is designed to function under the network and data base control of a larger IBM host system. Local WP or DP is performed on separate, dedicated display terminals, although some DP-type applications may be performed on WP terminals with display panel reprogramming. All program assembly, external system communications and data base transfers must flow through the host; no direct peer-to-peer 3730 data or document transmission are allowed. Market orientation is toward present IBM mainframe system users of the Fortune 500 class who desire WP and electronic mail capabilities in conjunction with present DP operations. IBM has recently announced support of 3730-type WP function and peripherals on the 8100, allowing an alternate approach or upward migration path to its large system users.
- **Wang Laboratories, Inc. OIS Series:** This family of integrated systems is an outgrowth of Wang's very successful WPS series of shared-resource word processors. As such, function is oriented more towards WP rather than DP. DP capabilities include a Basic compiler, WP-to-Basic file conversion and a just-announced legal accounting applications package. Intra- and inter-system communications is provided for electronic mail document transfers under Mailway software. Orientation is toward the office market requiring strong WP capabilities and a limited interest in DP.
- **AM/Jacquard Systems, Inc. J500/-J100:** Single- or multiterminal integrated systems first introduced as data processors but quickly augmented with full WP capability. Word and/or

(Continued on Page 50)

SYSTEM CHARACTERISTICS

SYSTEM	WORD PROCESSING FEATURES	DATA PROCESSING FEATURES	UPGRADES NEEDED FOR FULL INTEGRATION
Word Processors	• Operator-friendly menu-prompt text entry, format, edit and manipulation routines. • WP-function-oriented keyboard-display and document printer terminals. • Moderate-to-high vendor hand-holding.	• Programmable logic and diskette/disk storage facilities. • Calculator-type arithmetics. • Limited file processing. • Ascii-type terminal communications.	• Enhanced shared-resource control and disk storage facilities to support multiple WP/DP terminal configurations. • System software supporting concurrent WP/DP operations and file transfers. • Applications program; terminal/protocol emulator; electronic mail and filing software support.
Data Processors	• Text editing employing DP code commands on DP-function terminals.	• Programmable logic and diskette/disk storage facilities. • Applications program facilities. • Communications emulators. • Full file/records processing.	• Enhanced shared-resource control and disk storage facilities to support multiple WP/DP terminal configurations. • System software supporting concurrent WP/DP operations and file transfers. • Operator-friendly WP software. • Electronic mail and filing software. • Dual-function WP/DP keyboard-display terminal and document printer terminal. • Enhanced vendor hand-holding.

(Continued from Page 49)
data processing is implemented through same terminal with ability to perform file access and transfers from both text or data storage areas when terminal is in either mode. DP capability includes interactive data entry and file management system, communications emulators for IBM 2780-, 3780-, 3270- and Univac 1004-type protocols, Super Basic compiler and interpreter and accounting applications packages. It lacks electronic mail and document electronic filing functions. It does provide a good mix of DP WP capability oriented to DP or office, small- to medium-scale facilities seeking integration.

• **Four-Phase Systems, Inc. OMS/-IV:** Recently introduced upgrade to Four-Phase's Foreword integrated system that incorporates electronic mail and enhanced networking in addition to integrated WP and DP. It provides data entry, data base, batch and transaction processing capability and Cobol language support under multifunction executive with OS/DOS features. As with Jacquard system, the OMS/IV is equally at home in the small-to-medium DP or office environment.

• **Datapoint Corp. ARC:** This distributed multiprocessor DP system has been enhanced with strong word and document processing packages. It offers full network manager, communications, data entry, data base and time-shared access DP support; Basic, Cobol and RPG languages; and a number of applications packages. It is a good example on how to integrate WP, electronic mail and electronic filing functions into an existing DP product family. It competes in a medium-to-large scale market for users with primary interest in distributed processing as well as office automation.

These are but a few of the systems on the market that offer integrated WP and DP capabilities. Other vendors from the DP side of processing who have introduced integrated systems include Digital Equipment Corp., Basic Four Corp., Mohawk Data Sciences Corp. and Prime Computer, Inc. WP manufacturers who offer shared-resource systems with DP capability include CPT Corp., Lexitron Corp., Micom Systems, Inc. and Xerox Corp. All take a somewhat unique approach to integration with respect to features and functions provided and the ability to support ancilary electronic office operations. These then form the basis of integrated WP and DP in the early '80s.

WP/DP Checklist

The following checklist should serve as a guide to evaluating systems and their applications in a specific user environment:

• How large an operation is to be integrated? If a small single-terminal facility is envisioned, will dedicated word processing (WP) and data processing systems better support work loads when compared to a single system offering WP/DP integration features?

• In multiterminal, multiuser installations, is concurrent word and data processing supported on the system? If so, can WP or DP operations be run on the same terminal, or are dedicated function terminals employed?

• Can WP and DP files be accessed and transferred from a terminal that is in either operational mode?

• Are complete WP features and functions supported? Does the system provide equal WP capability when compared with a dedicated system: Do the termninals employed in WP offer user-friendly key arrangements and menu prompts?

• How complete are DP features and functions when compared with user needs for data base, data entry, transaction processing, batch processing operations and so forth? What languages are supported? Can programs be assembled on the system? What applications packages are supplied?

• How complete are communications and networking functions? Are various terminal and system emulators and protocols supported?

• Does the system offer ancillary electronic office-type functions such as electronic mail, electronic filing and electronic calendar scheduling? Is photocomposition supported?

• What upgrade or expansion paths are offered? Can the system be installed small and then migrated to larger configurations?

• How much experience does the vendor have in servicing an end-user market? Can the vendor adequately support or provide the degree of hand-hold that is often required by non-DP office operators?

The above checklist also provides a composite view of the full capabilities of systems expected in the mid-1980s.

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FORECAST '81

By Marcia Blumenthal

INDUSTRY OUTLOOK:

CAN DP VENDORS WEATHER THE STORM?

Although the computer industry weathered the 1980 recession relatively unscathed, companies are bracing themselves for further buffeting in 1981 by a troubled European economy and spiraling interest rates.

Vendors and analysts are not making doom and gloom predictions for 1981, but can best be described as "cautiously optimistic," a phrase which sometimes can be interpreted as crossing one's fingers.

Most mainframers saw 1980 earnings dip below 1979 levels in some quarters during the year, with other companies reporting flat earnings.

With inflation expected to be about 12% next year and interest rates now anticipated to top off at 22% during the first quarter of 1981, many suppliers may continue to experience an earnings pinch for the first half of the year, some analysts noted.

Order rates are going to soften during the first quarter of 1981, maintained William D. Easterbrook, vice-president of Kidder, Peabody & Co., Inc. Datapoint Corp., which had strong order gains during most of the year, experienced an order decline in the third quarter, denoting a softening in European markets, he stated. Since most firms depend on significant revenues from overseas markets — sometimes up to 40% of revenues — the crunch in Europe could take a toll on U.S. computer firms.

Last year the strength in the European market masked the deferment of orders by U.S. customers. NCR Corp. was one company whose financial performance was in part shielded by European gains.

Besides the economy in Europe, users there have become more nationalistic, increasingly preferring to buy from local companies, analysts noted.

While order recovery in the U.S. is expected to mask the impact of the European slowdown during 1981, high interest rates and a general attitude by consumers that another recession may be on the horizon could put a damper on the expected gain in orders, particularly on low-end systems

This phenomenon could also fuel a continued high lease/purchase ratio, which depressed 1980 earnings. "When interest rates are high, IBM becomes the bank of first resort," said Jay Stevens, senior technology analyst with Oppenheimer & Co., Inc.

Despite economic doldrums in 1980, users continued a run on orders for 32-bit minis and high-end mainframes, analysts agreed. On the whole, 1981 revenues for U.S. computer manufacturers will grow by at least the same amount as during 1980, remarked Frederic G. Withington, a vice-president with Arthur D. Little, Inc. (ADL). Withington estimated gross revenues at 20% across the board for the top 100 manufacturers. Other analysts estimated industry revenue growth at 13% to 15% for the coming year.

With most major companies now at the beginning of a new product cycle and production problems at a minimum, the outlook for shipments is good, noted Stephen T. McClellan, a vice-president with Salomon Bros.

The economic vagaries of 1980 aside, 1981 should see IBM making a great number of product introductions, particularly additional models in the H series, maintained Tom Crotty, vice-president of research at the Gartner Group. While 1979 and 1980 saw other mainframers under pressure to respond to the 4300, 1981 will force competitors to reveal their high-end wares, he said.

As usual, most mainframers claimed they were watchful but nonplussed by actions IBM may take, noting they are already committed to high-end systems.

Burroughs Corp. is readying its "Attack" model — the 7900 — which is an upgrade to its high-end 7800, according to J. Roy Henry, the firm's executive vice-president of marketing.

While Burroughs said it is prepared to compete on the high end, it has had a variety of production problems during the past year. In particular, Henry said the firm found it difficult to "ramp up" production of new products and experienced a severe shortage of semiconductor components. However, Henry reported Burroughs now has these problems under control and is looking for good shipment levels next year. But its lower end 3950 product is still on "indefinite hold."

Sperry Univac also said it will upgrade its large-end 1100/80 systems to meet IBM's challenge. "At any given time we have two generations of systems under development, which will be more than adequate to meet competitive challenges," responded Richard L. Gehring, president of Sperry Univac. It is impossible to have a good distributed processing system without a large central site to manage the data base, he added.

In the IBM plug-compatible manufacturer (PCM) arena, many analysts see a good year ahead for PCMs, but predicted they will be injured by IBM in the long run because of IBM's continued fiddlings of microcode.

Responding to these predictions, PCMs as usual shrugged their shoulders, saying, "Where have we heard that before?"

Yes, IBM will continue its emphasis on microcode in upcoming announcements, noted Carl Amdahl, executive vice-president of advanced technology and development at Magnuson Computer Systems Corp.

However, the portions of the operating system IBM has microcoded are relatively stable. "Those are the kinds of packages we find easy to put into microcode in the Magnuson machine," Amdahl explained. "People talk about microcode as if you can do anything with it. You can't," Amdahl declared.

Although alert to competitive tactics by IBM, PCMs see the need to offer value-added features for their products. Magnuson recently announced microcode assists for IBM's MVS and Cullinane Corp.'s IDMS data base management system.

During the coming year, Magnuson will continue to work with independent software companies to develop unique microcode assist features.

At National Advanced Systems (NAS), a unit of National Semiconductor Corp., David Martin, executive vice-president, said, "All the hullabaloo about 3081 microcode is a giant mirage." IBM has made extensive use of microcode for years, not only for original design but for enhancements which provided assist and instructional features. The 3081 is the next generational step in the use of microcode, but will not present a competitive disadvantage because microcode changes are the easiest to make.

IBM could do more damage by making significant changes in hardware design, Martin noted.

However, the real threat IBM presents in the near term is not "technical gotchas but predatory pricing action," Martin insisted. Pricing of the 4300 came pretty close to predatory tactics, but the pricing of the 3081 seems to indicate IBM will not resort to significant underpricing, Martin said.

IBM will attempt to control but not eliminate the market share of PCMs through pricing, but for the foreseeable future the demand for automation will provide enough room in the market place for current competitors, he said.

Moreover, the PCM industry will evolve during the next five years, becoming suppliers of much broader product lines. NAS already has the capability to offer processors configured with plug-compatible peripherals, and during the next year, will offer software tools such as performance monitors.

Plug-compatible disk maker Storage Technology Corp. is evolving its line towards total system capability. Amdahl Corp. recently made a foray into communications processors and reportedly has a disk controller project in the developmental stages.

Although the most popular ox to gore, the PCM makers will not be the only vendors subject to IBM's competitive tactics in the near future. IBM will go much more aggressively after markets it has largely ignored, such as distributed processing, high-end minis and word processing, Kidder, Peabody's Easterbrook noted. The giant may not introduce solid attractive products in these areas next year, but the trend is definitely in place.

One industry observer projected IBM would hold 50% of the high-end mini market for commercial customers by mid-decade.

At the lower end, IBM has become very aggressive with its Series/1, noted Terry Carleton, Kidder, Peabody's mini market analyst. "Anytime IBM established a competitive product in a new market, it takes a piece of that market."

IBM, however, won't be the only mainframer making significant moves to gain a position in new markets. This will surely impact smaller vendors, experts agree.

A recent example was Honeywell, Inc.'s year-end thrust into the 32-bit mini and word processing arenas with its DPS 6 family.

Describing the new products, Stephen G. Jerritts, president of Honeywell Information Systems, remarked the system differs considerably from a typical mini. The Level 6 is a smorgasbord of functions requiring individual configuration, typical of a traditional mini. On the other hand, today's users don't want to do a lot of configuring on their own, Jerritts maintained.

(Continued on Page 52)

Blumenthal is senior editor, industry at CW.

(Continued from Page 51)

Instead, users want preconfigured hardware and software and the ability to put all of this on a network. This is the direction Honeywell will be pursuing in the next year. Although the company said it will continue to introduce new models in its high-end Series 60, Jerritts said the Level 6 and DPS 6 will contribute 25% of HIS' revenues in 1981 and 50% by the middle of the decade.

And Burroughs Corp. at year end announced word processing capability for its 90, 900 and 1900 systems. Although a buzzword in the late 1970s, distributed processing will become more of a reality in 1981, vendors and analysts agreed.

A major source of growth during the upcoming year will be on-line networks for users' current applications, ADL's Withington stressed.

This will create a demand for more processors, disk drives and terminals, which will be good for established vendors because it is more of the same. Aetna Insurance Co. expects to increase its terminal installations from 8,000 units to 35,000 units in the next five years, he said.

"What we need to do now is increase the functionality of our software and distributed processing features," Sperry Univac's Gehring emphasized.

While IBM is expected to make inroads into smaller system products, the firm will also pursue software revenues much more aggressively in the coming years. Easterbrook estimated IBM might derive up to 5% of its revenue from software next year and could triple that during the next couple of years. Forecasts by Shearson Loeb Rhodes, Inc. noted IBM's software revenues from the 4300 series could produce revenues equal to those from that hardware and that sales of H series software could be 25% to 50% of the hardware volume.

Independent Software Firms

This aggressiveness is bound to put a pinch eventually on the independent software companies who compete in the mainstream of IBM products. These vendors will be impacted as IBM puts a lot more options and features into its IMS and CICS products, remarked David Eskra, president of Pansophic Systems, Inc.

Pansophic specializes in information retrieval and library control systems, but doesn't see too serious a challenge from IBM in this arena.

Besides IBM, Eskra noted 1981 may prove to be highly competitive among independent software firms. There will be a lot more competition for the software dollars at user sites with the overall software budget dollar leveling out, he observed, and users who have to make a decision between a utility or application package may make their decision on which package to purchase based upon which vendor "gets to the door first."

While IBM will certainly put the pressure on independent software firms, its ability to compete may be hampered by its size, suggested Alex Kuli, marketing director for Cincom Systems, Inc. IBM may have a difficult time creating new software products until it breaks up its software development operations into smaller, entrepreneurial units, such as existed with the creation of DOS. If IBM makes this transition it should have the clout to dominate the market, he predicted.

To help retain its competitive edge, next year Cincom intends to make the use of its data base management systems less complex and allow word processing information to be hooked into the data base, Kuli said.

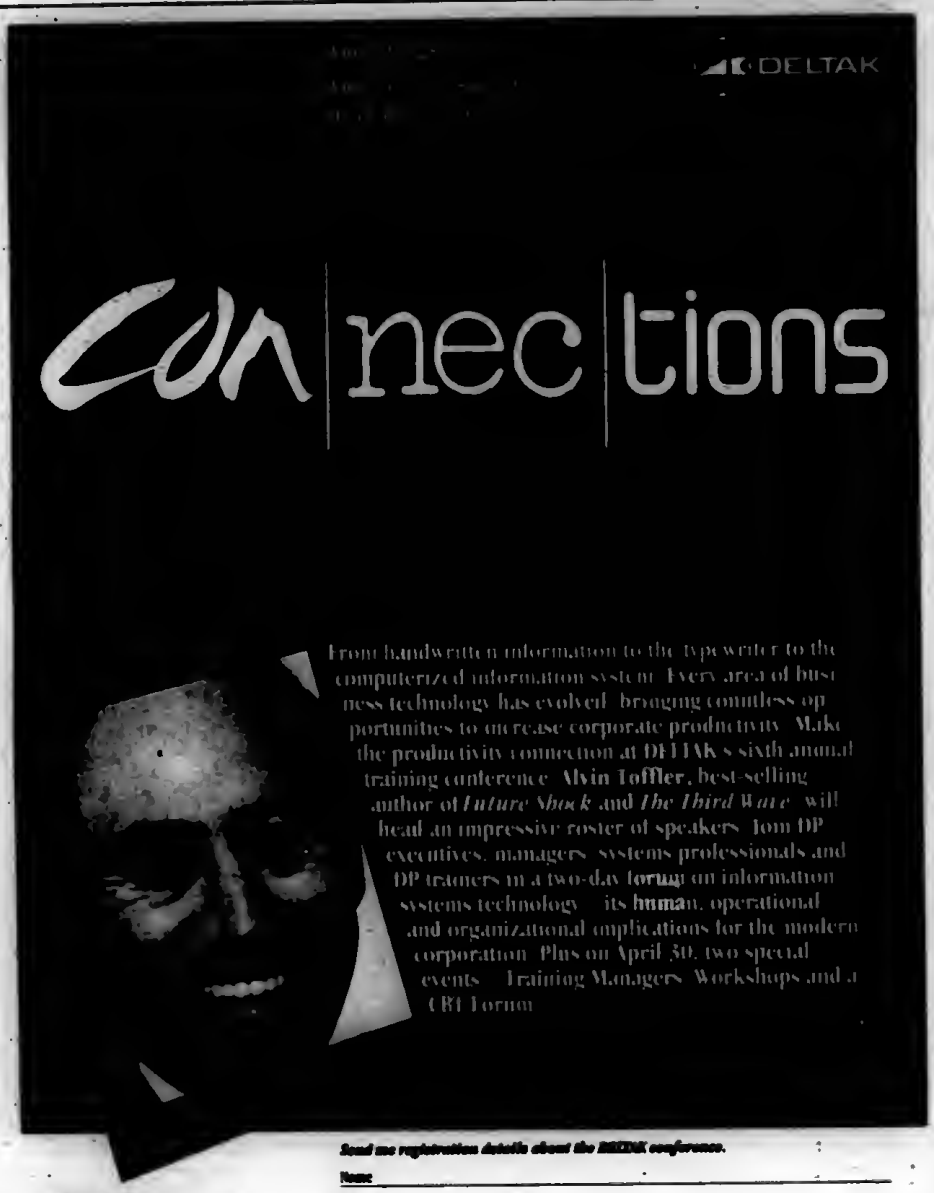
On-Line English

Cullinane Corp. will also continue developing tools to allow speedy applications development on its IDMS system. In addition, the firm will provide more tools such as On-Line English, which allows a nonstructured access to the data base for inexperienced users, according to Robert Goldman, senior vice-president of product development.

Moreover, Cullinane is developing or adapting standard application packages for use with IDMS.

With inflation continuing, users can expect to see price adjustments in its products. However, ADL's Withington does not think price increases will be very steep. "IBM has improved earnings under its current price umbrella."

And no forecast for the new year could be complete without remarking on the threat the Japanese present the mainstream computer industry. Although selling its products on an OEM basis to NAS, Amdahl and others, analysts and vendors interviewed expect to see the Japanese at most make a miniscule impact on the industry. Any inroads will be on the very low and such as personal computers, observers agreed.



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FORECAST—'81

By Marcia Blumenthal

VENTURE CAPITAL: AN ERA OF GLORIOUS NONSENSE FOR HIGH TECHNOLOGY FIRMS

Venture capital investment in high-technology companies today may be entering an "era of glorious nonsense." That aphorism has been used several times during the past 20 years to describe the cyclical frothiness of the venture capital environment. It appears the heady atmosphere for investment in high-technology firms will continue unabated for at least the next year.

For the past two years, 63% of the total venture capital invested went to high-techology firms. Of this amount, 25% was invested directly in computer-related firms, 9% in communications companies and 18% in other electronics companies, according to Stanley E. Pratt, publisher and editor of *Venture Capital Journal*.

During 1979 a record $1 billion was disbursed by venture capitalists to smaller business, more than double the average annual disbursements for the previous five years. In 1980, approximately another billion was invested, with a moderate increase expected for 1981, Pratt estimated.

From 1970 to 1977 the total venture capital pool remained static at between $2.5 billion to $3 billion. Since 1978 that pool has grown to nearly $4.5 billion, boosted by private capital commitments of $570 million in 1978, $319 million in 1979 and $800 million this year, he said.

And capital is coming from new sources. For example, once-cautious pension funds last year supplied 31% of the new committed capital.

Venture capital firms today are highly liquid, but more than that they are professionally managed, the opposite of the situation that existed in the mid-1970s — the Dark Ages for venture capital.

Along with liquidity and good management, several events have contributed to the momentum of the venture capital community and its investment in high-technology firms. The 1978 reduction of the capital gains tax from 49% to 28% has already spurred investment in venture capital. By nature venture capital investments are long-term, with investors earning the bulk of their money after five years.

Besides the easing of the tax burden, there has been a tremendous resurgence of interest in entrepreneurship and small business. The recent White House Small Business Conference stimulated awareness of the vigor and innovation that is characteristic of small businesses.

"Productivity," the buzzword for 1980 and probably for 1981 also, was repeatedly the headline of numerous articles in top business publications.

Some 54% of all venture capital invested in the past decade was related to productivity improvements, Pratt estimated, with the computer industry certainly in the vanguard of productivity enhancements.

The publicity given to the issue of productivity, along with the visibility of stock market results for high-technology companies, has stimulated the dizzying demand for investment in technology-related companies.

High-technology stocks were one of the top-performing investment groups this year, with new issues selling like hotcakes. Apple Computer, Inc., which recently went public, was oversubscribed long before the offering, Grokers noted.

Interestingly, of the 100 venture-backed but now publicly held companies tracked by *Venture Capital Journal*, 56 are computer-related

All this fervor for entrepreneurship and high technology, combined with the availability of venture funding, has provided the impetus for an exodus of would-be and "born again" entrepreneurs from established firms. A goodly portion of these entrepreneurs are not tinkerers, but rather are executives who have been successful in other firms and already have a market focus for their products.

"There are thousands of people in industry who could break out into more creative areas," asserted William H. Draper III, a general partner in Sutter Hill Ventures, based in Palo Alto, Calif.

Two notable executives who emerged again as entrepreneurs during the past year were John W. Poduska, one of the founders of Prime Computer, Inc., and Gene Amdahl, founder of Amdahl Corp.

Poduska, who recently became founder and president of Apollo Computer, Inc., [CW, Dec. 1], raised more than $4 million in venture funding.

Amdahl, who recently announced plans to take on IBM with an H-Series-type system from his newly established Acsys Corp., needs an estimated $70 million to finance that venture.

Although entrepreneurs with good ideals looking for venture capitalists abound, venture firms increasingly are finding themselves vying for investment positions in high-technology firms.

A case in point is the recent venture funding of a software firm where Fidelity Ventures found itself to be one of 18 investors hoping to invest in the company, reported Peter D. Danforth, a general partner in Fidelity. The eventual cost of that investment was twice what Fidelity was willing to pay, Danforth noted, ultimately causing the firm to walk away from the opportunity.

As Danforth sees it, the stock market performance is one reason the cost of venture investments is skyrocketing. Price/earnings multiples for high-technology stocks have recently been in the 25 to 30 range, far above those for established firms in related industries such as the computer industry.

As a result of this "frothy" market

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Blumenthal is senior editor, industry, at CW.

Priam Corp.

CUPERTINO, Calif. — Now in its third round of venture capital financing totaling more than $7 million, Priam Corp., founded in March 1978, will turn a profit during the first half of 1981, according to President William Schroeder.

Schroeder and his partner, Al Wilson, executive vice-president of Priam, left Memorex Corp. in February 1978.

The concept behind Priam was to adapt the Winchester technology of the IBM 3350 disk drive for minicomputers.

The first round of financing, $1.4 million, was completed in July 1978 and was used for product development; the second round of $2.6 million in August 1979 was geared to production facilities; and the third round, $3.1 million last May, is being used for all-around scaling up of the company.

Since its initial funding, Priam's shares have increased 300% to 400% in value, Schroeder reported. Despite this appreciation, the partners and employees own "far less than the majority of the firm."

Seven venture capital firms are involved in the firm with Sutter Hill Ventures, the lead investor.

The company's revenue is expected to reach $20 million this calendar year. "We could go public; a lot of development companies are doing that," Schroeder remarked. However, he thinks the public route would be premature. "We are building a large, important company. After all, our major competition comes from Xerox Corp. and Control Data Corp.," he said.

Schroeder recalled that the initial funding for the start-up and the third financing for ongoing company activities were relatively easy to obtain. Second-round financing, however, was a little more difficult. Investors know how to value a start-up and can get excited about an ongoing firm, but that gray period when "you are getting the product to work, getting orders and getting costs in line" is sticky, Schroeder noted.

Relational Technology, Inc.

BERKELEY, Calif. — While he was a vice-president at Cullinane Corp., Jon Nackerud became acquainted with a software product called the Interactive Graphics and Retrieval System (Ingres), developed at the University of California at Berkeley several years ago.

Excited about this data base management system, Nackerud brought it to the attention of his employer, John Cullinane, president of Cullinane Corp.

Although Cullinane was interested, he did not want to acquire the product. Instead, he introduced Nackerud to two West Coast venture capital firms, Sutter Hill Ventures and Hambrecht & Quist.

Eventually choosing Sutter Hill Ventures, Nackerud formed Relational Technology, Inc. earlier this year. Sutter Hill funded the firm for $300,000 and located Gary Morganthaler to serve as executive vice-president of the fledgling software company.

The firm introduced Ingres this month.

Although Nackerud said the principals could have financed the firm themselves, their venture partner provided the company with good contacts within the industry and in banking and allowed the firm to avoid scrimping to get the product to market.

Doctoral Developers

The developers of the product are all Ph.D.s affiliated with the university — Michael Stonebraker, Eugene Wong and Lawrence Rowe. They serve as consultants to the company, but do not participate in the day-to-day operation of the firm.

Although the company is a start-up, Ingres had been in use for more than four years and had 125 installations by the time Nackerud acquired the product.

His aim is to commercialize the product, offering technical support, something the university could not do.

(Continued from Page 53)
condition, entrepreneurs today can retain a greater share of the ownership of the firms than could their predecessors two or three years ago.

While high-technology investments have not yet run out of control, many venture capitalists see warning signals in the current boom that may have repercussions for entrepreneurs and investors alike.

Young firms may go public prematurely, Draper maintained, interpreting the euphoria for new issues on the public market a danger sign. "Whenever this happens people lose a lot of money."

Moreover, the Investment Incentive Act of 1980, which provides for public investment in venture capital firms, could be troublesome, venture capitalists agree, because public investors are often looking to turn a quick profit. This could adversely impact the entrepreneur who is building a company and cannot immediately produce profits and the venture capitalist who traditionally has been in the investment for the long haul.

Another negative factor in the current market is that venture capital firms competing for high technology investments are being asked to make commitment decisions too quickly, observed Henry McCance, a general partner in Greylock Management Corp. This leads to shortchanging the evaluation process, which is tantamount to a violation of good management practices, McCance warned.

Despite these warnings, Sutter Hill's Draper sees 1981 as a promising year for venture capital investment. New start-ups have not yet become too high priced. In funding start-ups the venture firm offers more than capital, often providing consulting to the firm, putting together its management team, evaluating the market for a particular product and making introductions for the new firm in the financial world.

Although start-ups may still be reasonably priced, many venture capitalists noted the second and third financing is where the competition is. One firm sold its start-up shares for $1 apiece, but managed to obtain $5 per share from venture partners on a subsequent financing.

Although high-technology start-ups often require the infusion of venture capital, such firms can opt for venture financing at various times during their development.

Relational Technology, Inc. is an example of a new start-up firm that sought funds immediately. Integral Data Systems, Inc., on the other hand, is a profitable firm with $10 million in revenue, which sought venture financing for the first time only recently. That firm raised $1 million.

Still a third — Prism Corp., a two-year-old disk drive manufacturer — is now in its third round of venture funding (see related stories).

Within the venture capital arena the most active segment is the 200 private partnerships and firms that hold between $1.5 billion and $1.8 billion of the total venture capital assets. During the past two years some 15 to 20 partnerships have been formed annually. This compares to only two partnerships formed in 1977.

Another active segment is the 330 or so small business investment companies (Sbic), of which only one-third are active venture capital investors. The Sbics hold about $1.3 billion in venture capital assets.

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Integral Data Systems, Inc.

MILFORD, N.H. — Integral Data Systems, Inc. was founded in January 1977 with no venture capital funding. One of the founders, Dr. James VanderMey, now president, had worked at Codex Corp., now a subsidiary of Motorola, Inc.

VanderMey saw the need for a low-cost dot matrix printer to be used with minis and microcomputers. The products developed by Integral Data sell for $800 to $1,795 per printer.

For its last fiscal year, ended in June, the firm had revenues of $9.5 million and was profitable.

A year ago VanderMey decided to pursue venture capital funding and received about $1 million from Greylock Management Corp. and Fidelity Venture Associates. These investors have banking connections, understand the company's markets and the problems of small businesses, VanderMey noted.

The company had previously financed its growth from retained earnings, but wanted to establish banking relationships.

Although the venture financing was the company's first, it was like second-round financing because the owners did not have to yield much of their equity.

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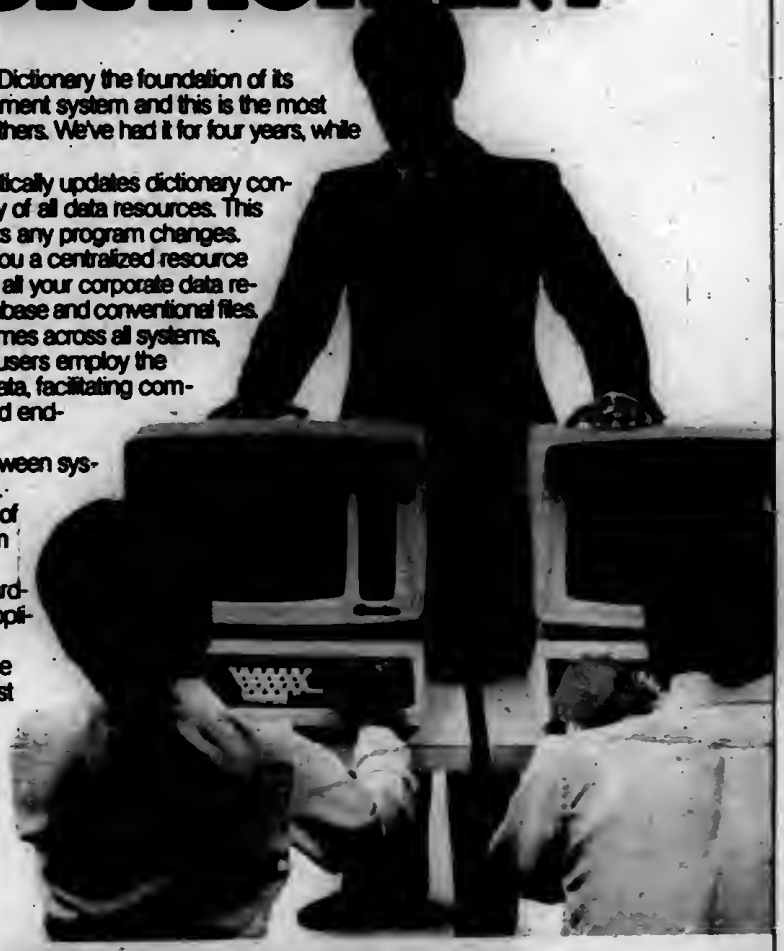

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FORECAST '81

NETWORK ARCHITECTURE:

The world is likely to move closer to standardization of data network architectures in 1981, but specifics of the expected standards will probably take several more years to define.

The big question many data communications users want answered next year is how far IBM will go in fitting its Systems Network Architecture (SNA), the bedrock of IBM communications offerings, to the evolving Open Systems architecture of the International Standards Organization (ISO).

Some large IBM customers assume the vendor will close the gap by offering domestic users compatibility with the X.21 and X.25 interface "standards" contained by the ISO model's first three layers. The ISO has yet to define the highest four layers of its architecture, but the organization has made clear its commitment to a concept of networking systems that runs counter to the approach IBM has long promoted.

Thus far, SNA has called for a fairly rigid hierarchy of master/slave relationships among remotely linked systems. And some communications experts have charged that SNA protocols and software make it difficult for users to accept non-IBM systems in SNA networks [CW, Oct. 6].

Work on the architectures for long-distance transmission became enmeshed this year with efforts to develop architectures for local-area transmission, which is usually defined as communication within a radius of a mile or a couple of kilometers.

In practice, a long-distance architecture will usually need to accommodate several local nets and both kinds of architecture will need to meet many of the same communications standards, such as X.21 and X.25. Coaxial cabling seems the favorite medium for local nets at present.

Recognizing a need for "openness" in networks, meaning smooth links between many different brands of systems, the ISO and sympathetic bodies such as the Consultative Committee on International Telephone and Telegraph (CCITT) and American National Standards Institute (Ansi) have labored to develop standards for interfacing data terminal equipment (DTE) — communicating processors and terminals — to public data nets.

Signaling a break with IBM's traditional approach to data communications, IBM Chief Scientist Lewis M. Branscomb told an international conference this year that SNA will come to feature "more and more peer capability and more and more openness" [CW, Nov. 3]. IBM will supply networks with systems for communication with many other brands of systems, Branscomb predicted.

IBM has no choice, consultant Jon S. Gould pointed out. No single vendor can hope to supply all systems for a large, sophisticated network in the 1980s, the O'Donnell & Associates, Inc. vice-president explained. For one thing, companies that merge with other companies must absorb each other's DP resources, and this is rarely done without running lines between different brands of processors.

Also, major vendors like IBM cannot profit from competition with much smaller firms in supplying certain specialized systems and therefore will choose not to, Gould stated. Many large users will need a few of such systems.

Branscomb's speech came a few weeks after Honeywell, Inc. and Sperry Univac announced that their respective network architectures would meet X.21, X.25 and generally the rest of what turns up in the ISO model [CW, Oct. 27].

Honeywell's Distributed Systems Architecture (DSA) was the only general-purpose, mainframe-based net architecture launched by a major vendor in 1980. Called the "blueprint" for Honeywell's DP products in this decade, DSA will embrace the openness trend and make a point of supporting systems under SNA, spokesmen said [CW, Oct. 13].

On the occasion of DSA's unveiling, 1973 Turing Award winner Charles W. Bachman, a Honeywell senior consultant who chairs the ISO subcommittee on Open Systems and until recently chaired the comparable Ansi committee, remarked:

"In the long term we have to assume that all computers, whether they're used by banks, governments, larger business corporations or small businesses, are going to have to cooperate with everybody else's computer on behalf of their owners. If that's so, the rigidly hierarchical approach of master/slave computer relationships is fundamentally wrong."

At odds with IBM tradition, this view from the man who won computer science's Nobel Prize for contributions to data base technology may be striking some IBM marketing strategists as a thunderclap.

In coming years, the major systems vendors, including the largest, must standardize communications between each other's systems without constant monitoring from the user's central headquarters: That's the message of 1980.

Among key changes in policy and offerings for SNA this year, IBM released several software enhancements based on the VM/System Product that purport to bring the full gamut of SNA capabilities to the terminal level of decentralized and and-user networks [CW, March 3]. Related to this, IBM indicated its VM/370 operating system will no longer be enhanced without charge and the VM/370 System Control Program "will be enhanced minimally, if at all."

As IBM continues to withhold X.21 and X.25 support domestically, vendors of competitive products have not — NCR Comten, Inc.'s 3600 front-end processors, for example [CW, July 14] — and pressure is mounting on the world's largest DP supplier to join the bandwagon.

Some large IBM customers with extensive overseas operations have written X.21 and X.25 along with SNA into long-term plans for network expansion because much data communications abroad demands the compatibility and these users expect IBM to come through [CW, Nov. 24]. IBM does offer X.21 and X.25 to customers in several foreign nations.

For IBM's part, Branscomb has maintained that the vendor's U.S. customers have no great need for X.21 or X.25 until the nation's common carriers, especially Bell, support those interface specifications first [CW, May 26].

Bell and other carriers that derive the bulk of their revenues from circuit-switched network offerings have no great need for X.25, the CCITT recommendation for interfacing DTE to packet-switched networks, some observers have said [CW, Dec. 1].

Should Bell put X.25 in its long-awaited Advanced Communications Service (ACS), however, IBM might react with the same sentiment as the coming White House to a Soviet invasion of Poland. X.25 in ACS would mean Bell customers — most American businesses — could run non-IBM terminals in place of IBM's 3270 models.

On the other hand, X.25's *absence* from SNA might hinder Bell's efforts to put ACS in IBM shops. ACS is expected to meet the CCITT recommendation, as the packet nets of GTE Telenet Communications Corp. and Tymnet, Inc. already do.

But X.25 itself is not without problems. The de facto standard's written description is hundreds of pages long, according to Jacob Sternberg, chairman of Conversational Systems Corp. "It looks like a Russian encyclopedia," Sternberg remarked. As different portions rise and fall in favor, "it's Stalin in — Stalin out."

According to Sternberg, whose company made a system that switches a fourth of the New York Stock Exchange daily traffic, the real test of the standards incorporated by emerging architectures will come with implementation over the next few years.

"There will be no real conclusions until at least 1983," he predicted.

According to Gerard L. Power, a Pennsylvania State University computer scientist, the main problem in fitting SNA to X.25 — the problem IBM may solve for domestic customers next year — is SNA's path control "sublayer."

Incompatible with X.25, this sublayer breaks messages into packets and adds both addressing and sequencing information to each packet. This determines which node in the network each packet will visit next and how the packet is to be combined with other packets to reconstruct a message.

SNA's bit-oriented Synchronous Data Link Control (SDLC) protocol is a functional subset of the High-Level Data Link Control (HDLC) protocol contained by X.25 and which forms the second layer of the ISO's model architecture, Power noted. But the path control incompatibility gives IBM two ways to go in giving the nation's SNA users X.25.

IBM can either insert a "black box" — some device — between SNA and the X.25 network or rewrite SNA's path control sublayer, Power observed. Neither solution is appealing, he said, and a few alternatives are even less desirable.

IBM customers in France and Canada have resisted offerings of X.25 translators by which they could attach the Transpac and Datapac public networks, Power added.

Independent vendors interested in giving SNA users improved access to the X.25 public nets could try developing a black box for protocol conversion that would be inserted between the user's 3705 communications controller and the X.25 net, according to W. Gary Greathouse, project manager of Sc ..-Honeywell, Inc., a company formed this year to manufacture packet-switching products.

Or, Greathouse continued, such vendors could try writing software to reside in the 3705, IBM's front-end processor for its mainframe systems, that might render the necessary protocol conversion and possibly eliminate a need for the expensive link hardware on which many IBM users presently depend for a pipeline between their shops and the public packet nets.

The latter approach was taken by Comm-Pro Associates, a firm specialized in 3705 software, in developing a package for use with IBM's Network Terminal Option for the Network Control Program. Comm-Pro's revised X.25 Network Access Software is said to reroute the connections between interactive asynchronous terminals and X.25 nets into a "multidomain SNA network" [CW, Dec. 22].

Comm-Pro's Christmas present for SNA users is claimed to void the distinction between 3270 terminals directly connected to IBM mainframes and those terminals linked to X.25 packet networks.

Using popular terminology, the ISO

Schultz is senior editor, communications, at CW.

FORECAST-'81

By Brad Schultz

SNA vs CHALLENGERS

model's lowest layer, X.21, describes the lines between network nodes; the second layer, HDLC, describes passage of data packets over lines; and the third layer, X.25, describes the passage of entire messages between nodes.

Awaiting definition: the fourth layer, transport, concerns transfer of messages from end-user to end-user; the fifth layer, session control, orders logical sessions; the sixth layer, presentation, maps information; and the seventh layer, application, applies that information in representing the end user to the system.

Nearly all the major systems vendors aimed at the U.S. market have now issued a network architecture. These include Burroughs Corp.'s Burroughs Network Architecture; NCR Corp.'s Distributed Network Architecture; Digital Equipment Corp.'s Decnet; Hewlett-Packard Co.'s Distributed System; Prime Computer, Inc.'s Primenet; Data General Corp.'s Xodiac; and Univac's Distributed Communications Architecture.

"One trend that will occur during the next few years is the upgrading of the vendors' architectural implementations," according to Bolt Beranek and Newman, Inc.'s Marianne Steiner and Ira Richer. "Moreover," they continued in a portion of *Advances in Data Communications Management, Volume One*, "in the future we expect that the different classes of users will begin to require more of the same types of functions.

"For example, minicomputer users taking advantage of Decnet will require more intelligence in the nodes, whereas IBM users will require more interprocess communication," they added in the book just released by Heyden & Son, Inc. of Philadelphia.

"The solutions offered by the different vendors will tend to converge, Steiner and Richer asserted. "For example, DEC is already moving its general-purpose communication function to front-ends."

As work proceeds next year with defining the ISO model's highest four layers, the major vendors will continue fleshing out their architectures with actual products.

And people will try using those products — which is, of course, the bottom line.

Local Loops

The advent of several local network architectures in 1980 may signal next year's marketing strategies for the major data-communications suppliers.

Local loops, the data transmission links within a large building or a cluster of adjacent buildings, typically handle two-thirds the total volume of a big organization's data communications.

Some experts have argued that network planners should focus on the local traffic situation rather than the full gamut of remote processing operations to be encompassed by IBM's Systems Network Architecture (SNA), Xerox Corp.'s Xerox Telecommunications Network (Xten), Bell's Advanced Communications Service (ACS), or similar solutions.

One reason for bringing planning to the grass-roots level is that most of the action goes on there, but another is simply that all-encompassing designs for links across nations or around the world are too complicated to be well understood and not flexible enough to handle the impacts of corporate mergers and reorganizations or industrial vicissitudes.

It is really the old pitch for modularity in solving a complicated problem. Break the big mess into simpler subproblems, some consultant have counseled [CW, Nov. 24]: Once the local net situation is licked, the user can simply latch together its various local nets and run telecommunications as a utility.

Most universities and colleges with computer science programs have pet projects in local net design. For one thing, a college campus is — one might say — a text-book setting for such a facility.

Workers in academic buildings can benefit substantially from easy message-switching on circuits not in thrall to telephone companies. And the expertise needed to string up and maintain a local net is often available from modestly paid faculty, students and the plucky crew of technicians that serve campus laboratories.

Hence, this nation and other nations have produced innumerable local net designs that might contend for honors as a "standard." Next year, the major standards-making organizations relevant to data communications will continue efforts to produce a standard.

In the U.S., the National Bureau of Standards has produced documents and sponsored seminars toward this end, but the spotlight has recently shifted to the Local Area Networking Committee of the Institute of Electrical and Electronics Engineers (IEEE), chaired by Maris Graube of Tektronix, Inc.

As 1980 becomes history, Graube's committee is close to recommending IEEE Standard 802, but remains stymied by the issue of how to assign access rights in a local loop. Two incompatible approaches are under consideration: carrier sense multiple access collision (CMSA/CD) and token passing.

Ethernet, a local network architecture under joint development by three vendors, has CMSA/CD, which involves statistical sampling of lines to see whether data streams are colliding. Token passing allows only one user at a time to run data through the local net.

The proposed Ethernet is a passive coaxial cable-based medium for transmission among smart and dumb terminals. Its sponsors — Digital Equipment Corp., Intel Corp. and Xerox Corp. — plan to give the architecture "gateway" access to long-distance telephone circuits and the ability to multiplex voice communication with data [CW, May 26].

Until a few months ago, Ethernet appeared likely to be much the same as IEEE Standard 802, but important differences have cropped up. Although Ethernet is pegged for 10M bit/sec transmission, the IEEE wants a wide range of speeds permitted by its standard. Graube's committee has tentatively settled on 1M-, 5M-, 10M- and 20M bit/sec [CW, Dec. 1].

A few weeks after DEC, Intel and Xerox released specifications of Ethernet [CW, Oct. 6], Satellite Business Systems announced a deal with Network Systems Corp. to offer its all-digital specialized common carrier services through the Hyperbus local net architecture Network Systems offers for 50M bit/sec transmission. Through the Hyperchannel within Hyperbus, that rate is held possible for distances of 5,000 ft or less between local net nodes [CW, Oct. 27].

"Hyperbus exhibits strange behavior in that its performance depends upon the actual configuration of users on the system" according to Ivan T. Frisch, senior vice-president of Network Analysis Corp. in New York. His analysis of Ethernet, Hyperbus and Mitre Corp.'s Mitrenet — featured in *Computerworld*'s Nov. 24 Special Report on network planning and implementation — found problems with all three local nets in achieving 10M bit/sec rates.

Mitrenet, however, can be modified easily to allow 10M bit/sec transmission, Frisch maintained, so a 100M-bit file could be moved between buildings with a 10-sec response time without affecting the local net's interactive traffic.

According to some observers, the multimegabit/sec rates local nets will offer in coming years will trivialize issues of access priority, since low-priority users will have virtually the same wait-time as high-priority users.

The super-rates may also eliminate a need for much of the protocols and software used to handle transmission errors, since the user could simply retransmit any faulty messages as soon as fault was found.

Another local net debut in 1980 that should keep the arena lively next year is Zilog, Inc.'s Z-Net, a packet-switched coaxial-based architecture intended to integrate DP, electronic mail and office automation traffic.

The main idea behind the Z-Net design is distributing a system's low-cost elements such as CPU, memory and terminal while sharing such high-cost elements as peripherals and data bases. Zilog, an Exxon Corp. affiliate, chose to unveil Z-Net within a few days of the Ethernet announcement and then, during the week Ethernet's specifications were publicized, introduced major Z-Net enhancements.

The latter included an asynchronous, bidirectional first-in/first-out buffer circuit for Z-Net users that reportedly provides elastic buffering between a CPU and peripheral circuits. This Z-FIO unit was accompanied by Z-Lab, a "method of physically distributing hardware and software development stations while keeping them part of an integrated system," a spokesman said.

Recent maneuvers within the Exxon Information Systems division, which along with the rest of Exxon Enterprises, Inc. is being absorbed into the parent company, Exxon Corp., suggest that Z-Net may loom large on the local net scene next year in terms of product announcements and simple promotion.

One tack for local network architectures to take in 1981 is stringing together desktop systems hitherto marketed as personal computers. Zilog's Z-Net will compete with architectures such as the Cluster/One from Nestar Systems, Inc., based on the Apple II systems from Apple Computer, Inc.

Ohio Scientific Co., acquired this year by MA/-COM, Inc., has also worked on fashioning a local net from its desktop family, and Apple's release of the Apple III, far more powerful than present competition in what is usually considered the personal computing arena, will probably spark efforts to build that desktop into a local net driver.

Another local-net architecture to watch next year is System 20 from Network Resources Corp., a Sytek, Inc. subsidiary. System 20 is reportedly able to support more than 24,000 terminals at 9,600 bit/sec for an aggregate link-level data rate of more than 14M bit/sec.

According to Sytek, the System 20 "allows transparent communications between all terminals in the network, provides for data encryption and interfaces to long-haul as well as internet and intracity connections."

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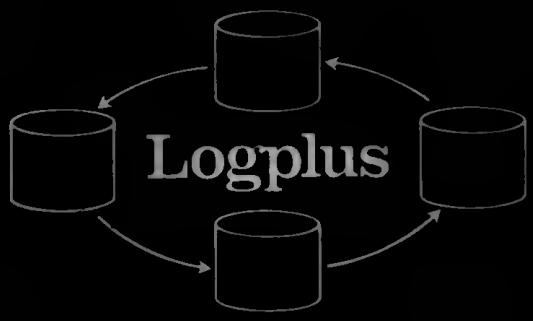

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SOFTWARE

FORECAST-81

By Tim Scannell

USER vs VENDOR: THE LEGAL BATTLES CONTINUE

Their sales tactics range from the age-old foot-in-the-door technique to an occasional bit of verbal sleight-of-hand.

And while they do not wear the stereotypical loud plaid uniform of the sideshow huckster, if given the chance, they would probably sell you a product that not only balances your payroll, but tucks you lovingly into bed at the end of a long hard day.

Like the machines they sell, today's computer sales people are technically sophisticated and rely on a number of state-of-the-art tactics to bolster their sales pitch. But, by the same token, most of them frequently use song-and-dance sales routines that date back to when cavemen in three-piece bear skins marketed the first wheel.

In the past year or so, more and more users have filed suit against vendors, claiming they have been the victims of precontractual sales promises. Recently, a precedent was set in litigation history when a major computer manufacturer was actually found guilty of fraud for misrepresenting a machine's capabilities.

Just a few months ago, the aggressive actions of a relatively small user against a major vendor snowballed into a blizzard of at least more than 50 lawsuits claiming similar damages.

Unfortunately, even with the help of the courts, users are discovering that it is a lot more difficult to return a malfunctioning computer than it is to return that oversized Christmas sweater. And things will get more difficult in the future, especially for the user who puts more faith in the salesman's spoken words than what he signs for on the dotted line.

"When you're dealing with large organizations with complex products to sell, [the salesmen] get pressures, and quality control is not what it should be," according to Samuel B. Harvey, a senior vice-president with RHS & Associates, Inc., a New Jersey consulting firm. Whether it's computers or anything, there's going to be guys who will sell somebody something that they don't need."

When a user is stuck with a malfunctioning system because he was undersold or oversold on what the machine could do, he has only himself to blame, Harvey said. After all, "if you go into a store and buy something that doesn't fit you or that you don't need, to a large extent, it's your responsibility."

Harvey admits there is such a thing as the young and aggressive sales person who, during the heat of competition, focuses on nothing but getting the "fish on the hook." He also claims that it is a fairly standard procedure to simplify a user's requirements during the initial sales phase and, in some cases, "perhaps onder-engineer the job a little bit."

These tactics are far from being fraud or deception, he added. On the contrary, they are just the by-products of healthy competition. And "if you're going to have a free competitive market, which we do . . . then we have to expect these guys are going to get in there and compete," Harvey explained.

Sidney Segelstein, a New York lawyer who has been involved with computer contract law for the past 15 years, agrees that vendor sales people might sometimes overemphasize a system's capacities, and that users should not walk blindly into a contractual affair. In fact, he has coauthored a book on the subject of computer contract negotiations with noted computer expert and fellow lawyer Richard Brandon. A second book by the legal duo, this one aimed at the virginal user, is scheduled to be released sometime in the beginning of 1981.

While Segelstein admits users should be cautious, he also feels some drastic changes are needed on the part of the computer manufacturers.

"Vendors tell you a lot of things about the characteristics of the equipment in terms of reliability, in terms of speed and in terms of capacity," Segelstein stated. "That's the way they sell."

Then the vendor hands the user a contract which he says is a formality, but which actually consists of a series of disclaimers. The contract usually disclaims any expertise with the user's application or warranty that the computer is suitable for any particular purpose, Segelstein said. In fact, most contracts do not even refer to the computer as a system or state directly that it performs any function at all.

"All the things that they put into the initial proposal, whether they are verbal or written, are negated by the contract," Segelstein pointed out. "There are no reflections in the contract of the kind of inducements that made the buyer's blood race faster, or the things that got him all heated up about the product in the first place."

As the price of hardware descends — making a computer affordable to people who know absolutely nothing about the technology — vendors are becoming more and more reluctant to make any kind of formal commitment. Binding contracts are dismissed as simple purchase orders, and potential users are told to "forget about all that fine print on the back," Segelstein claimed.

"In the early days of DP, he continued, there may have been some justification for very tight and "disgracefully unprotected" contracts. The computer field was, for the most part, experimental and was growing at a phenomenally fast pace. Equipment and software came out before being adequately tested. Such gear was sold to large users, like insurance companies, that had some idea of how a computer was supposed to act. These early users also had enough corporate power to get satisfaction from a vendor if a particular system did not perform as promised.

Today, however, salesmen are using the same tactics to pump out hardware to a relatively unsophisticated audience, Segelstein said. "They never give the customer any idea of what's supposed to happen next. They hand them over to these OEMers who are either sloppy, over-burdened, lowballers or whatever.

"The way our legal system works today, the user is at fault for not reading his contract and demanding . . . that he get some real protection." If the disgruntled user throws up his hands and pulls the vendor into court, the suit will more than likely be decided in favor of the vendor, Segelstein observed. In effect, the judge and the jury will say, "You're a big boy. You never should have signed the contract and now you've got to pay the price."

So far, the only success a user has had in fighting a large vendor and its legal juggernaut is by accusing the vendor of fraud or blatant misrepresentation. In the recent Triangle Underwriters, Inc. vs. Honeywell, Inc. case, for instance, the jury dismissed charges of negligence and breach of contract against the vendor defendent, but upheld the charge of fraud. Honeywell was first ordered to pay Triangle, a now defunct insurance broker, more than a million dollars in damages.

However, a few weeks later, a trial judge reviewed the case and reduced the amount of damages to $35,000. He based his decision on testimonies filed by both parties and some allegedly missing documents that could have weighed heavily in the case. So, even when the user wins, he may lose in relation to damages that result from a bum system.

Distant Light

To make the light at the end of the legal tunnel seem even more distant, Segelstein warned that the laws of commerce make fraud one of the hardest charges to pin on even the most apparently guilty vendor. "Its just not the way the world works." Whatever edge the frustrated user has now as an abused David going against a powerful Goliath is diminishing all the time, he said. Ultimately, the only person who can prevent needless litigation and keep the trusting customer happy is the front-line salesperson. The person who knocked on the client's door with colorful brochures describing the computer system in one hand and promises in the other.

"Vendors have to stop marketing computers in the same puffy way that they've been doing," Segelstein stressed. "There's a vast amount of unhappiness and disappointment. All you hear is problems," he said. And nobody is happy in part because vendors have inflated the customer's expectations.

"They're not in a position to produce [total happiness] and they shouldn't sell computers that way," he stated emphatically.

Whoever is to blame for a malfunctioning computer, whether it is a slick and over-zealous salesperson or a totally incompetent user, one thing is certain — more and more potential machine owners are opening their eyes a little wider before signing on the dotted line.

Unfortunately, "even though there is now a growing awareness of things that could go wrong with a computer,

(Continued on Page 60)

Scannell is senior editor, hardware, at CW.

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(Continued from Page 59)

computer contracting does not yet resemble normal, prudent business practices," Joseph Auer, editor of *Computer Negotiations Report* (CNReport) observed.

Auer insisted that demand has never been greater for his monthly newsletter, which reports on the various twists and turns of modern computer contract law and occasionally blows the whistle on a vendor through its "Ploy of the Month" feature. He is also kept busy guiding the user flock by hosting seminars sponsored by CNReport's publishing parent, International Computer Negotiations, Inc.

Although the newsletter's circulation figures are proprietary, Auer stated that he averages about four- to five inquiries per day from disgruntled users or fledgling DPers who want some kind of contracting assistance. In fact, user complaints have just noticeably risen over the past five years. The user's laments are all usually the same: They think the vendor is trying to pull a contractual "fast one."

"Every vendor contract has a clause in it that says if it is not part of the contract, it's not part of the deal," Auer pointed out. "They disclaim every reason you wanted a computer in the first place."

For the prospective buyer, Auer advises what mothers have been insisting all along — an ounce of prevention is worth a pound of cure.

"Anticipatory protection is better than litigation every time," he noted. "Even when users imagine they want a computer, they ought to notify all of the vendors that during the acquisition process, they expect everything the vendor says, writes or does during the sales campaign to be part of the contract.

"In so many cases, users don't get the vendors to even represent that they'll do anything specifically," he added. Instead, "they are sold on grandiose very general broadband terms."

Users Beware

Auer warns users to be particularly mindful of turnkey vendors, who will be more prevalent in the next few years. These vendors can be extremely dangerous to deal with because the buyer is usually left with no contractual link to the software or hardware supplier. There is "no flow through of warranty," he claimed. "This little turnkey house can be two guys working out of a '59 Chevy parked next to a telephone booth," he continued.

If the delivered system does not work or a problem develops, what does the user do? And if he decides to bring the issue to court, who does he sue?

"The size of the deal in some ways is not big enough for anybody to be concerned about except the poor guy who's getting it in the teeth," he said. Unbelievably, there have been an incredible number of these type of cases just in the past six months.

Despite all the doom and gloom directed at the first-time computer user — especially the very vulnerable small business person — there are some rays of hope. Influenced by user criticisms and growing mistrust of the industry, a number of vendors have instituted policies of even firmer "hand-holding" in their customer relationships. For instance, Data General Corp. publishes several first-user manuals on the subject of computers that are conspicuously devoid of self-gratuitous back-slapping. And companies like IBM and Digital Equipment Corp. have 24-hour toll-free hotlines that can be used to ask questions directly to the firms' technicians and system hotshots.

While these seem like nice gestures, CNReport's Auer believes that the vendors are increasing hand-holding tactics because the competitive market necessitates it, rather than doing it out of the goodness of their hearts.

Contract Advice

Finally, there are several things a potential user can do to combat what one chief executive officer of a major computer firm, currently involved in a precedent-setting lawsuit, called "the number one cause of all present and future computer litigation" — the young, aggressive and over-eager salesperson.

First of all, get both the vendor and user sides clearly defined in the contract down to generic responsibilities, task levels and implementation schedules, Editor Auer said. "Vendors don't mind negotiating this type of contract because they like to know what their specific responsibilities are . . . and what the users are going to do. And they also like to know when they're through."

Contract lawyer Segelstein simply advises to listen very carefully to the vendor. "Every piece of paper he hands you, every statement he makes, you write down and memorize it someway. And then try to get it in the contract."

When courting vendors, a buyer should be seductive yet firm, Segelstein continued. He should also not be afraid to push too hard or threaten to drop the vendor if his demands are not met. A lot of large vendors will turn tail and run at the first sign of a pushy customer "and concentrate on the fellows who are ready to sign on the dotted line," — which is just as well for the cautious buyer.

As negotiations reach the wire, get the vendor to spend a little time and money by setting up machine demonstrations and scheduling visits to similarly equipped shops. "The vendor is less likely to walk away after he has dedicated marketing time, energy and money," Segelstein observed.

Finally, the neophyte user should prepare for the worst, or at least a rollercoaster-like sales ride, before opening up the vendor catalogs and selecting that cute little dream system. Unlike fairy tales, where computers are concerned, there is no such thing as "living happily ever after."

"I see people getting told that computers are the greatest thing since sliced bread," Segelstein said. "And a year later, after the system has died four times over and they're ready to chuck it out, they realize — they are in data processing, and this is what data processing is all about."

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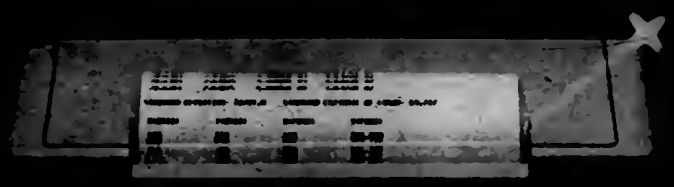

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FORECAST-'81

By Jake Kirchner

WASHINGTON ROUNDUP: A CLEAN SWEEP?

WASHINGTON, D.C. — The favorite cliche here these days is that the Reagan administration will "hit the ground running," and by every estimate it will do just that — moving quickly to cut taxes and trim government spending. But for the many complex issues whose resolution determines federal information policy, the best that can be reasonably expected is plodding but steady advance.

Computer manufacturers and vendors of information equipment and services are eagerly awaiting the economic moves expected from the corporate Camelot the Reagan team is quickly assembling here on the Potomac.

The corporate tax cuts, accelerated depreciation schedules and research and development (R&D) tax credits anticipated from the pro-business Reagan administration and conservative Congress bode well for all industry, but particularly well for capital-starved high-technology firms.

However, the social and human issues posed by technology, issues already clearly defined in many cases, may settle to the bottom of early legislative and regulatory agendas in the new year.

Nevertheless, privacy, transborder data flow, federal DP practices, U.S. Postal Service electronic mail initiatives, AT&T entry into unregulated data processing services and the myriad thorny issues attending this country's growing information economy will certainly receive renewed attention during the coming months.

The Carter administration has received high marks for addressing these and other information policy issues and there is no indication the Reagan team can or will want to ignore them. In the slow but deliberate policy-making process of Washington, D.C., issues, once articulated, tend to take on a life of their own.

Many of these information issues, such as privacy, barriers to international information flow and the need for more economical use of federal information processing resources, are essentially nonpartisan and are, according to many observers here, moving inexorably toward resolutions unlikely to be drastically affected by the conservative tide of November's elections.

This is not to say, however, that there will not be changes, perhaps drastic changes, in the emphases certain information issues are given by the new administration and the Republican-dominated 97th Congress.

A clearer picture of the 1981 information policy agenda will not be available until congressional committee and subcommittee assignments are finalized in February and the 300 or 400 top executive positions are filled.

One issue that can be considered a bellwether for federal information policy over the next year or two is privacy. Since the 1974 Privacy Act and the 1977 report of the Privacy Protection Study Commission (PPSC), questions of government access to personal records and the threat of automated recordkeeping systems to the confidentiality of those records have been debated at great length both on Capitol Hill and at the White House.

The Carter administration is generally credited with doing much to promote privacy legislation. One administration official likened Carter's response to the PPSC report to that of "a kid with a new toy,'(and the administration's so-called "privacy initiative" led to a number of legislative and regulatory proposals to implement the commission's recommendations.

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Kirchner is a correspondent for the CW Washington bureau.

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But the response of Congress clearly did not meet the President's expectations. There Carter's efforts were torpedoed, partly by his own team, by federal agencies — notably the FBI and the Treasury Department — that feared their ability to access citizens' financial, medical and insurance records would be unduly hindered.

This internal dissension was overcome in the case of the Right to Financial Privacy Act of 1978, but has been a large factor in dragging out other pieces of privacy legislation. This, along with a lack of what Richard Neustadt of the White House Domestic Policy Staff describes as a "constituency for privacy" have lengthened the privacy legislation process.

Illustrative of these problems was the fate of medical records privacy legislation during the last Congress. Brought up for a vote in the House of Representatives Dec. 1, the bill, although backed by numerous hearings and the approval of three separate House committees, was quickly killed by legislators who cited opposition to the legislation by the Federal Bureau of Investigation and "the intelligence community."

Republican opponents of the bill promised to bring it up again early in the next Congress. But their suggestion that the measure should also be cleared by the Judiciary and Intelligence Committees indicates the task congressional privacy proponents face in the coming year.

Players Lineup

The intelligence agencies have long been prime players in some of the toughest information policy debates in Congress, and the Republican sweep of November will do little to change that.

One example: Congress for years has wrestled with the question of whether to permit the FBI's National Crime Information Center (NCIC) to implement a message switched telecommunications system to transfer computerized criminal histories between state and federal law enforcement authorities.

Civil libertarians, who have long argued the NCIC proposal smacks of a "Big Brother" national police system, are now openly worried the new, conservative Congress will readily embrace any law and order proposals and will give the FBI and other law enforcement agencies carte blanche to develop their technological capabilities.

Viewing the electoral defeat of liberal senators such as Birch Bayh (D-Ind.) and John Culver (D-Iowa), one Senate Judiciary Committee source put it this way: "Civil libertarian-wise, you can pack up the game; it's all over. No question about it, the FBI will get whatever they want."

Presumably this will include beefed-up NCIC systems and stalled, or at least watered down, privacy legislation.

That, of course, is an admittedly worst case scenario. Other observers note that the big unknown in the privacy debate is the philosophies of incoming legislators. Many of the newly elected Republican senators and representatives, it should be remembered, espouse a states rights attitude, which may tend to tamper intelligence community bids for powers that could be seen as constituting federal interference in state law enforcement activities.

Also, as one White House adviser noted recently, Congress has been severely embarrassed by the revelations of congressional bribe-taking related to the FBI's so-called Abscam operation and may not take kindly to any FBI proposal. According to this theory, the Congress will be greatly interested in privacy, if only for self-protection.

The way the new Administration and Congress approach these federalism issues will affect a number of issues relating to technology and law enforcement. The Transportation Department's proposal to implement a national, message-switched telecommunications system to beef up the National Driver Register to track illegal drivers is just one example.

Another is the federal computer crime bill stalled by congressional attempts to rewrite the entire federal criminal code. The FBI has vowed to push for the bill, despite the opposition of some state law enforcement authorities and despite the fact the legislation's sponsor, Sen. Abraham Ribicoff (D-Conn.) is retiring from office.

Increasing Efficiency

In a related law enforcement issue — combatting fraud and abuse in federal programs — Congress and federal agencies have shown steadily increasing willingness to employ sophisticated technology.

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grams to identify welfare cheaters, student loan defaulters and other abusers of federal largesse has grown in popularity to the point that many congressional spending bills now include provisions for computer use to increase efficiency of federal programs.

The shock tactics proposed by designated Office of Management and Budget (OMB) director Rep. Dave Stockman (R-Mich.) to cut agency spending suggest increased use of computer matching techniques. Similarly, Sen. Richard Schweiker (R-Pa.), the day after he was announced as Reagan's choice for Secretary of Health and Human Services (HHS), said fraud and waste in HHS programs would be one of his first concerns.

Schweiker reminded interviewers that he has proposed cutting off federal funds to states that do not employ computers to make their Medicare and Medicaid programs more efficient. This type of computer use is something he wants to see more of, he said.

There are a whole series of related proposals to use computers to make government more efficient. OMB estimated recently, for example, that the government has not collected on outstanding debts of almost $175 million.

About $25 million of that constitutes money federal agencies would not or could not collect, including approximately $15.5 million in delinquent taxes. There is a growing congressional support for more Internal Revenue Service funding to increase its DP capacity so it can collect a greater percentage of the taxes owed [CW, Nov. 10].

In fact, a whole range of government information processing practices will be on the agendas of the Reagan administration and the new Congress. The recently passed Paperwork Reduction Act mandates a broad reorganization of agency respunsibilities in acquiring and managing information resources [CW, Dec. 8].

When the law takes effect this spring, OMB must assume a greater burden for planning, procuring and managing information processing equipment and services. OMB's efforts will be overseen by the law's sponsor, Rep. Jack Brooks (D-Texas).

Brooks, a longtime advocate of increased and more economical computer use by federal agencies, remains chairman of the House Government Operatons Committee. As such, he will have as much, if not more, to say about federal DP practices and policies than anyone in the new administration.

But, in the long run, the development of federal information policy will depend on the ability and willingness of Congress as a whole to tackle some of the tough issues new technology raises.

A prime example is the protracted congressional effort to rewrite the 1934 Communications Act. The central question of how to restructure AT&T to allow it entry into the data processing field has been complicated by vigorous lobbying by Bell, its opponents and labor organizations, as well as the involvement of the courts. One of the biggest obstacles to pushing through the rewrite legislation, however, has been the "massive indifference" to the issue in Congress, according to Neustadt.

The rewrite bill is expected to come up early in the new Congress, but its prospects are clouded by the federal antitrust suit against AT&T and court challenges to the Federal Communication Commission's (FCC) Second Computer Inquiry decision that would allow Bell to enter unregulated data processing markets [see story on Page 19].

(Continued on Page 69)

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(Continued from Page 65)

One backer of the legislative effort, Rep. Albert Gore (D-Tenn.) also noted the bill has become something of a hot potato on Capitol Hill. Its main proponent over the years, Rep. Lionel Van Deerlin (D-Calif.) was defeated in November, and his opponent's charge that the legislation would raise home telephone rates contributed significantly to his loss.

Van Deerlin's defeat will make it harder to persuade other members of Congress to fight for the legislation, Gore predicted. He added that this and other information issues are a "real challenge" to Congress. The short-term outlook for Congress' meeting that challenge is not good, according to Gore, who said "I am a realist and do not have much optimism."

"The public rewards that ought to adhere to work in the information areas will increase as people become aware of the importance of these issues," Gore continued. People in the U.S. are only now beginning to realize "the significance of the information revolution," and there will be "increasing politicization" of related issues that will be harder and harder for Congress to ignore, he said.

Test Run

An early test of congressional willingness to tackle information issues will be the fate of the House Government Information and Individual Rights Subcommittee. Its chairman, Rep. Richardson Preyer (D-N.C.) was another victim of the November massacre and there is now a proposal to disband the subcommittee and spread its responsibilities among other government operations subcommittees.

Even if it remains intact, without Preyer the subcommittee's mandate to take on information issues could be severely weakened under new leadership.

Preyer has been for many years at the forefront of congressional attempts to address information issues, spearheading the fight for more privacy legislation and a more coordinated U.S. response to transborder data flow problems, to name just a few of his initiatives.

Another Preyer project was taking the U.S. Postal Service (USPS) to task for its nine-digit Zip Code scheme. Thanks largely to his efforts, the House and Senate agreed two weeks ago to delay the new Zip Codes until mid-1981.

The delaying measure, which would have allowed both houses to more carefully scrutinize the Postal Service effort to use automation to cut costs, did not survive the preadjournment parliamentary wrangling of the 96th Congress. Even so, the widespread support the measure gained on both sides of the Hill seems to assure that the new Congress will take a long look at the Zip Code expansion program.

The Zip Code expansion plan is just one of several postal technology issues Congress is expected to take up next year. Its proposal to enter the electronic mail marketplace is expected to come before the Senate Communications Subcommittee some time in 1981.

How Congress will go on the Postal Service's Electronic Computer-Originated Mail (Ecom) proposal is not clear at this point, but there has been considerable lobbying by private industry to at least limit Postal Service involvement in the types of telecommunications services private firms are rushing to offer.

Early Indications

Perhaps indicating the new administration's stance on Ecom, former FCC chairman Richard Wiley, now heading the Reagan transition task force at the Justice Department, said recently "If private industry can do the job, the government ought to get out; this extends to USPS as well."

If Wiley's philosophy is echoed by others in the Administration, it could bode well not only for the U.S. telecommunications industry, but also for vendors of on-line data bases and other sophisticated information services that are currently fighting to keep the government from competing with them.

One communications issue that seems assured of greater emphasis in 1981 is that of transborder data flow. After extensive congressional hearings and a House subcommittee investigation, Preyer introduced a bill that would drastically restructure federal activities in responding to data flow problems encountered by U.S. firms [CW, Dec. 15].

Although Preyer was not reelected and the bill was introduced too late in the session for the 96th Congress to act on it, there is reportedly enough bipartisan support for it to move forward in

(Continued on Page 68)

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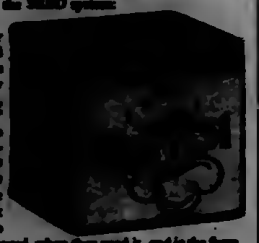

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FORECAST '81

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the new Congress.

There is also the possibility the Reagan team will reorganize the executive branch along lines that will preempt some of the provisions of the data flow legislation. In any case, it is apparently an issue whose time has arrived.

An official with the U.S. Trade Representative's Office noted recently the growing realization in official Washington of the importance of open international communications. "With the Hill beginning to push hard and everybody else beginning to recognize . . . how important it is," the official said, "I don't think that even if Reagan came in relatively opposed — and I don't think that would be the case at all because it's too important to the economy — that we wouldn't be moving ahead on it."

Enlightened Staffs

One school of thought has it that congressional consideration of the transborder data flow issues, with its aspects of international trade, finance, communications, technology and information policy, will help prepare the Senate and House for debates on a number of different information issues.

And, in the long run, the sophistication of all members and committee staffs of Congress will determine how information issues progress during the next several years. According to transition team member Wiley, Capitol Hill staffs are already "light years ahead" of where they were only a few years ago in being able to understand and handle information issues.

The significance of that remark can be gauged by keeping in mind that it is the staffs, both on Capitol Hill and in the executive agencies that handle most of the particulars of complicated issues such as those of information policy. It is often they who educate members of Congress and the Cabinet to the importance of these issues.

Indeed, staffing is currently the No. 1 priority in this town, both for the incoming Administration and for the Congress. With the new Republican majority in the Senate, many of the subcommittee staff positions are turning over. The same process is going on on the House side, where 74 new members take office in January.

But the 4,000 or so Capitol Hill positions changing hands pale in significance when compared to the turnover in the agencies, where at least 10,000 people will be brought in through political appointments and to fill jobs left vacant by the retirement and transfer of high-level civil servants.

The possible demise or downgrading of the Preyer information subcommittee and the rumored breakup of the National Telecommunications and Information Administration, which serves as the President's chief communications adviser, only add to the uncertainty of those concerned with federal information policy.

Corporate Model

In the final analysis, every one of the information issues mentioned above is up in the air. Much will depend on where the longtime staffers who have been fighting for these issues end up in the administration and Congress, whether they remain to push the issues on the new cabinet and congressional committees or are lost in the bureaucratic shuffle being orchestrated by Reagan and the new legislators.

On the administration side of the equation, one close Reagan adviser, former Diner's Club chairman Alfred S. Bloomingdale, was quoted recently as saying "running the government is like running General Motors." Indeed, the president-elect is staffing his administration as one would a large corporation.

What this will mean for information issues is at the moment unclear. How the corporate executives, supply-side economists and neoconservative politicians flocking to this city will approach information issues is as yet an unanswered question.

But if General Motors is truly to be the model for the new government, it should perhaps be noted that the giant auto maker currently advertises itself as the largest producer of computers in the world. Then again, General Motors is part and parcel of the same industry that brought us the Edsel.

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FORECAST '81

By Rita Shoor

DEFENSIVE SOFTWARE DEVELOPMENT

CHICAGO — When more than 100 lawyers from firms throughout the U.S. spend two full days discussing the implications and ramifications of computer software litigation, it is safe to assume that more information specialists than ever can expect a day in court relatively soon — maybe even in 1981.

Most speakers at the National Software Protection Conference here recognized that the jargon tied so closely to lawyers' and software programmers' specialties could make interaction difficult at best. "Most lawyers think Fortran and Cobol are wash-and-wear fabrics," admitted Robert Milgrim, a specialist in trade secrets (see related article). He was only half-joking.

However, Albert Madansky, a professor of business administration from the University of Chicago, managed to cut across this language barrier to speak to the nonlawyer conference attendees with his paper on "Defensive Software Development."

Rather than discussing issues of physical security or legal protection mechanisms, he confined himself to software-specific items that might be incorporated during the software development process. If they are implemented, these techniques may lead to successful prosecution of an unauthorized appropriator of trade secrets, according to Madansky. And, if a user should wind up the defendant in such a case as that involving Minnesota Title Financial Corp. [CW, Dec. 1], these items may provide some pointers for defense.

First, Madansky recommended a concept called "development accounting." This is not a financial accounting of project costs, but a process by which "the entire history of program development and inspection is recorded and summarized for management review."

According to one of Madansky's sources, development accounting requires a group of nonprogramming personnel who maintain the status of the programs being developed and record the history of this development. These people, who were compared to financial accountants, are also required to archive all documents generated during the development process — including faulty computer runs. The programmer is no longer responsible for managing the program materials.

While this type of program development history would seem to lead to "paper overload," R.C. Linger and H.D. Mills claimed in their book, *On the Development of Large Reliable Programs*, that this would not happen for the following reasons:

- Fewer runs would be made because "high-precision" programming techniques including the development history itself provide a better information base for the programmers.
- Development accounting leads to better clerical procedures which, in turn, permit easier access to large volumes of paper. In contrast, the authors described programmer-kept histories as "usually piles of unburst listings."

Madansky maintained that development accounting facilitates the recording of trade secrets while they are actually being created rather than after the fact. These secrets are not thought of in the planning process nor are they "readily identifiable upon looking at the final product," he said.

The top-down approach during the program development process was second on Madansky's list of recommendations. He defined the methodology as requiring a flowchart of major functions to be accomplished by the program. The flowchart is then tested — mostly through a set of dummy programs — and then each major function in that flowchart is broken down into subfunctions to produce a more detailed flowchart, which is again tested.

Aside from arguing the virtues of this process for designing programs, he indicated that the succession of flowcharts at various levels of the software development makes it easier to recognize the main ideas of the trade secrets being protected.

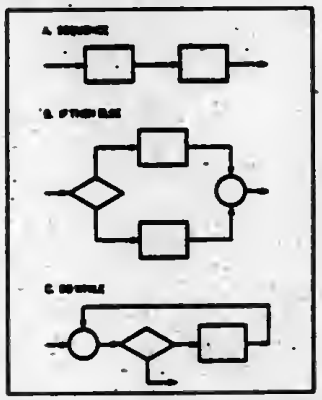
Mandansky advised the use of modular programming as a technique that allows the trade secrets to be more recognizable in the code itself. He gave the following rules of thumb for constructing the modules:

- Use symbolic parameters rather than embedded constants.
- Centralize assignment of values to parameters.
- Separate I/O from computational modules.
- Avoid sharing temporary storage locations.
- Use general-purpose subroutines as much as possible.

Madansky's fourth suggestion was to use structured programming — a technique that has generated an increasing amount of interest among *Computerworld* readers during 1980. He described this concept as consisting of the following processes: direct sequence; IF ... THEN ... ELSE; DO WHILE (see accompanying flowcharts).

In addition to blending with the top-down concept and being self-documenting, structured programming makes the disguising process which usually occurs when a program is stolen both more difficult and more apparent, Madansky maintained. The disguised program is usually a deliberately obscure version of the original and the structured form makes it easier to detect the transformation process.

He also advocated the use of decision tables to document the nature of the



logical flow of basic and secret algorithms. While it is easy to alter a program's flow and the accompanying flowcharts, it is much more difficult to disguise this type of basic algorithm, he noted.

Sixth on his list was a recommendation to create an inventory of programming styles of the people who were involved in the original software development. This library could be used as an aid to spotting vestiges of that style in allegedly misappropriated software. He also suggested including a slight, deliberate error in each program — a technique that has been used successfully by map publishers to detect plagiarists.

Finally, he recommended that the software creator produce a catalog of the software's functions and features and annotate this catalog by pointing out what "potential extensions and/or modifications are merely that and not representative of novel development." While the features comparison is the weakest disproof of theft of trade secrets, he said, such a catalog might be useful as a counterargument.

FORECAST 81

By Rita Shoor

SOFTWARE LITIGATION TRENDS

CHICAGO — Trade secret law, copyrights or patents — these are the tools available for protecting software.

But which choice is best? When lawyers from all over the country met at the recent National Software Protection Conference here, the consensus seemed to be that while trade secret law offers the best software protection, it is essentially a Hobson's choice.

The legal profession's fascination with these choices is probably prompted by the fact that litigation involving software may be on the rise. While the courts began to address the problem in 1980, as evidenced by the U.S. Supreme Court's decision to take up two cases involving patent protection for the computer industry [CW, Aug. 25], lawyers attending the conference predicted an increase in software litigation cases for next year.

One reason for the upswing in court cases may be that the available options are "old legal techniques which are being crammed and squeezed" to fit the needs of new technology. That was the opinion of Roger Milgrim, an adjunct professor of law at New York University's Law School, who spoke on "Trade Secret Law to Protect Software."

While conceding that patent law, copyrights and trade secret law are less than perfect, Milgrim flatly told attendees, "If you're not interested in less-than-perfect legal solutions, let's all go home."

The shortage of programmers in a labor-intensive industry will make a secondary contribution to the number of times software has a day in court. A shortfall of approximately 50,000 programmers has been predicted for 1981. This would naturally lead to a severe shortage of new application software. Therefore, as Milgrim pointed out, the pressure to misappropriate, misuse or otherwise improperly channel proprietary software may reach a "distressingly high level."

Rita Shoor is senior editor, software, at CW.

An awareness of the current attitude of the courts toward computer software is obviously necessary for any software development firm. However, end users and purchasers of proprietary software would also be well-advised to keep up with current litigation trends. This is illustrated by the recent suit brought against Minnesota Title Financial Corp. for alleged theft of a program licensed to the firm by Programmed Closing Systems, Inc. [CW, Dec. 1].

Both patent and copyright law were given relatively short shrift by Milgrim as far as software protection is concerned. He described the Copyright Act of 1976 as an "execrable piece of legislation . . . very complex and convoluted." Its most useful purpose may be that of "providing more activity for lawyers," he quipped.

Assuming that President Carter signs the recently passed Copyright Act of 1980 into law, it will supersede the 1976 act. However, one speaker who delved more deeply into the implications of the legislation described sections of the 1980 act as "rather poorly drafted" (CW, Dec. 15).

Peter Maggs, a specialist in copyright law from the University of Illinois felt that many of its potential loopholes result from a technological orientation that was "10 years out of date". Maggs indicated that copyright protection might be desirable for manuals tied to a computer program or for software that makes obtaining signed trade secret agreements impossible because of its mode of distribution — but not for complex software containing trade secrets.

If copyright law is less than satisfactory, patent protection does not look much better. Firms considering patent applications for proprietary software might do well to consider court decisions for the last 10 to 15 years, Milgrim cautioned. More than 70% of all patents adjudicated in court have been held to be invalid or unenforceable, he said.

While it is conceivable that the two upcoming Supreme Court cases might be exceptions, Maggs felt that "it will be the rare . . . program that is patentable." And, since it is necessary to reveal the underlying technology of an invention to obtain a patent, the software developer has little recourse if the patent is later deemed invalid.

Finally, although a patent offers considerably more protection than does trade secret law, there is little provision for enforcement, Milgrim said.

So, one is left almost by default with trade secret law, which leads to a new set of considerations. For example, trade secrecy offers no protection against the possibility of a third party developing essentially the same software independently and without access to a protected product. In addition, unlike the Copyright Act and Patent Act, trade secret law has no statutory framework. It was essentially "pulled out of the sky from common law" and is almost decided on a case-by-case basis, according to Milgrim.

Keeping this in mind, how does one ensure that he is entitled to trade secret protection? First, one must establish that the matter being protected is actually used in one's business. Second, it must be something "not generally known" in one's trade or business. Third, this information must lend some sort of competitive advantage. Finally, it must be used secretly.

Given these restrictions, the software developer must answer several questions correctly if he hopes to utilize trade secret law. Is he using his software secretly if his employees have access to it during its creation? Milgrim said that if the employer follows "basic steps" of limiting access to those employees with a "legitimate need to know," the answer is yes.

But what happens when you market the software? Once you have licensed the software for use by clients, can you still be said to be using it in secrecy? Milgrim's answer was "probably . . . if you employ the appropriate contractual and other techniques to ensure secrecy."

This means binding the recipient to respecting secrecy — something that may not be particularly easy to do when enmeshed in the selling process. After all, the client must guard his own interests by limiting his potential liability vis-a-vis a licensed software package as much as possible. In addition, the client's attitude may be, "We'd rather not be bothered . . . we don't know if we can police it and we don't want to take on obligations like that," Milgrim warned.

Another problem may arise because programmers often have the tendency common among scientists to "spill their hearts out" about their projects. The employer must make sure employees understand — preferably by contract — that what is imparted to them or developed by them in the employer/employee relationship is subject to restrictions on use or disclosure. They must realize that they cannot later work for a competitor and use this knowledge again, Milgrim emphasized.

While the best way to prevent competitive use of trade secrets is to restrict competitive employment, this is not possible in some states. California — one of the country's centers for computer software development — has a specific law to prohibit noncompetitive covenants, he pointed out.

Even with these gray areas, Milgrim indicated, trade secret law is generally preferable to either copyrights or patents on software.

Until the courts have set up some precedents to recognize software as a process, method or an idea, trade secrecy may well provide the best available protection.

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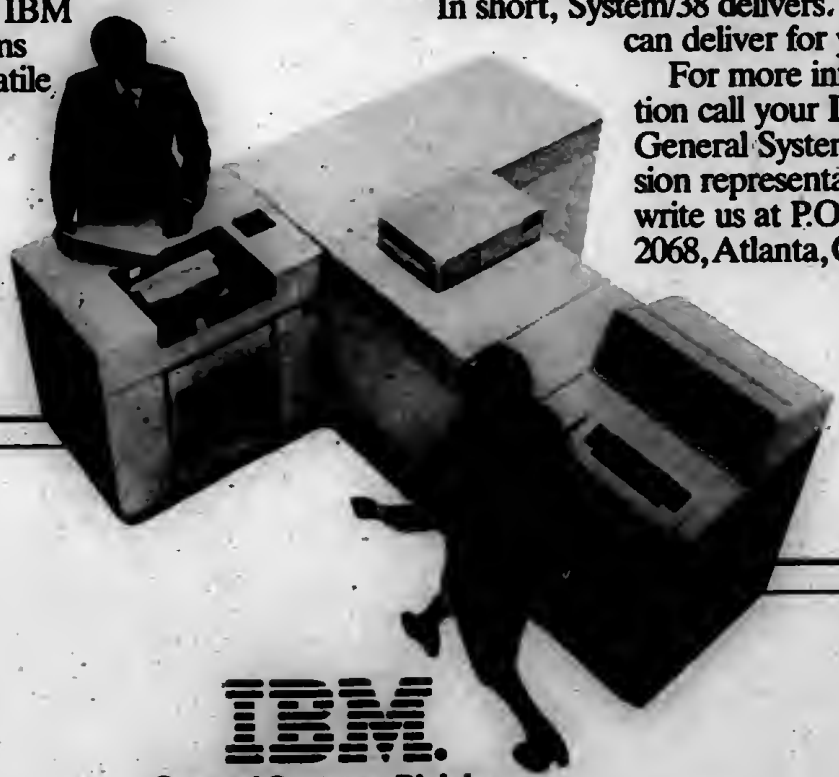

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FORECAST '81

TECHNOLOGY TRENDS FOR THE BELL SYSTEM NETWORK: Interview With John S. Mayo

How do you see the Bell System network of the future — say, 10 years from now — in terms of the technologies on which it will be based?

We're sure to see rapid growth in the use of digital techniques and software-controlled systems. Both these trends were spawned by advances in microelectronics technology, which have made them economically practical. Today, digital electronics and software-controlled systems are finding a place in every nook and cranny of the network.

Light-wave transmission will become increasingly important. The potentially low cost of light-wave systems and their ability to readily handle high-speed digital signals will result in more and more transmission of information by photons, rather than by electrons.

Computers ranging in size from single chips to large maxicomputers built into the network already make it highly intelligent. As greater numbers of circuits are packed onto silicon chips, we'll be able to put even more intelligence into the network of the future. Because computers run on software, software technology is becoming the foundation of this network.

What will this new technology mean to customers?

This largely digital and very smart network will enable the Bell System to bring a host of new services and features to our customers. For example, we can extend stored program control almost without limit to meet a wide variety of customer needs. In stored program control, a machine is controlled by instructions stored in a memory and executed by a processor.

Low-cost digital electronics means that customers will be using more machines and terminals that "speak" to each other in digital signals. The network has always been able to handle these signals, but as it evolves, it will handle them more efficiently. This will bring the customer new and affordable services, ranging from energy control to computer networking.

How widely will light-wave transmission be used in this network?

I think light-wave transmission will be used more extensively than most people thought when the technology was first introduced. There are several reasons for this, but perhaps the most important has been the development of very low-loss fibers. Fewer repeaters are needed to transmit a signal over a given distance, and equipment costs are reduced. Low-loss fibers make light-wave systems particularly attractive for overseas communication via submarine cable.

As digital technology becomes more important, so does light-wave transmission. Light-wave systems are usually digital: Information is transmitted in a digital stream of light pulses. The fact that light-wave cables are small, immune to electromagnetic interference and easy to install also contributes to the pace at which light waves are entering the network. And the raw material of glass fibers — sand — is much more plentiful than copper. There are several Bell System light-wave systems in service today.

What developments are needed before light wave can be used in the subscriber loop, the telecommunications link between the central office and the customer?

I think light wave in the subscriber loop is primarily an economic issue. The technology we have today, in fact, has been used in the subscriber loop.

For example, there's an installation in Connecticut and the Lake Placid system set up for the Winter Olympic games — both are basically subscriber-loop arrangements.

But what you have in mind, I'm sure, is using fibers for the very large number of loops going directly into customers' homes and businesses. Light wave is best suited to bulk digital communications. While it will become economically practical to use light-wave systems to bring a large number of channels to the vicinity of a cluster of customers, it will be quite a while before it is practical to run fibers right up to their telephones.

Moreover, connecting the fiber directly to the telephone leaves some problems still to be fully solved. For example, fibers cannot yet carry as much power as wire pairs to ring main stations and extensions. But we're making progress in this area.

Bell Labs is working on light-wave communications systems that transmit light of lower frequencies, or longer wavelengths, than existing light-wave installations. How will these systems increase the usefulness of light-wave communications?

Principally by improving the economics. The actual and theoretical loss of fibers is considerably lower with the longer wavelengths. Because this allows increased spacing between the signal-regenerating stations, the total cost of the electronics needed along the light-wave route is considerably reduced. With longer wavelengths, we can also transmit information at faster bit rates, which offers another economic benefit.

The first long-wavelength light-wave communications system, which uses a light-emitting diode, is now being tested by the Bell System in Sacramento, Calif.

The Bell System has been using satellite communications for nearly 20 years. How will future satellite communications differ from systems now being used?

I think the difference will be measured in terms of flexibility and capacity. Scanning beams — one possible approach to adding to the geographic locations served by a satellite — is a concept announced by Bell Labs researchers some time ago. Scanning-beam satellites would be more selective than today's satellites. Rather than showering signals over a wide area, they would use sharply focused beams to deliver digital signals to hundreds of earth stations. And a gradual move to higher frequencies will give us more bandwidth, so satellites will be able to relay a greater number of signals simultaneously. The increased bandwidth also allows greater flexibility in handling digital signals.

We should also keep in mind improvements in the components that go into satellites. For example, our echo canceler chip has especially improved the quality of satellite-transmitted conversations. Right now, Bell Labs is making important advances in the design of gallium arsenide field effect transistors, which we're using in amplifiers for our terrestrial microwave systems. These transistors will also be used in satellite systems. And our research and development work with batteries continues to increase the useful lifetimes of communications satellites.

Meanwhile, what is the future of the analog portion of the network? Will analog remain an important transmission technique?

Analog facilities have significant versatility — they aren't limited to transmitting only analog signals. We've been transmitting digits over analog facilities for a long time. And there's a significant advantage in transmitting some types of signals in analog form over certain facilities — voice, for instance. You can't transmit voice signals digitally over a 4-KHz channel and get good quality. There are some applications, particularly with radio systems, where the extra bandwidth needed to transmit digital signals limits equipment capacity and makes digital transmission costly.

I think the time scale involved in digitization of long-haul facilities via light waves and satellites spans many years. During this period, our trans-

Mayo is executive vice-president for Network Systems at Bell Laboratories in Murray Hill, N.J.

His responsibilities at Bell Labs include electronics technology, transmission systems, switching systems, operations support systems and network planning.

In a copyrighted interview with the Bell Laboratories Record *(November 1980), Mayo discussed both established and emerging technologies and their impact on telecommunications. Mayo was interviewed by* Record *Associate Editor John H. Ten Eyck.*

FORECAST '81

By John H. Ten Eyck

mission needs increasingly will be met by digital facilities, reducing the role of analog facilities in the network. But I don't see any places where anyone wants to go out and displace analog equipment or not use it to its fullest capacity. Quite the reverse. It will be used very effectively for many years to come.

The Bell System is in the process of deploying a nationwide network of software-controlled electronic systems larger than any existing or planned computer network. How close are we to achieving such a total stored program controlled network, and what do we still have to do to get there?

From the point of view of technology, we are very nearly there already. By that I mean that over half of the toll circuits today are served directly by stored program controlled switching systems; and in 1979, the number of trunks equipped for common channel interoffice signaling (CCIS) nearly doubled. CCIS is a separate intelligent network that carries call setup and disconnect information between stored program controlled switching systems. Back in 1965, we introduced stored program control into local switching, and a sizeable part of the local plant, too, is now equipped with ESS machines.

Are developments in hardware or software the stimulus to the stored program controlled network?

Both. Hardware and software are not as separable as they once were considered to be. Maybe the stimulus is a combination of the two in the form of systems architecture. Systems architecture — an extension of what we used to call systems engineering and systems design — considers both hardware and software. This unified approach accounts for much of the flexibility of the stored program controlled network when it comes to changing the network or updating it to meet new demands and to provide new services and features.

We hear a lot about the evolving Integrated Services Digital Network, which will further extend digital technology and services into the existing telecommunications network. What is the Integrated Services Digital Network, and what steps are being taken by the Bell System to implement it?

The Integrated Services Digital Network is more of a concept than an actual network, and it means different things to different people. Generally it is a combination of digital switching systems interconnected by digital transmission facilities and linked to customers by digital subscriber loops. This network would carry high-speed digital pulse streams to homes and offices equipped with digital terminals.

In a sense, we already have an integrated services digital network. Digitization of the telephone plant has been proceeding according to a general plan set up a long time ago.

Will there be a role in the network for intelligent terminals, or distributed processing, where local terminals or small computers can be programmed to handle some of the work of large, centralized computers?

Yes. From a network viewpoint, the beauty of intelligence spreading out to the ends of the network and penetrating customer terminals is that it will give rise to lots of exciting new services — many of them inherently digital. One of the drawbacks to an extensive digital capability in the network has been that there weren't all that many digits to transmit. So, the more the merrier, as far as digits are concerned.

How will new developments in electronics technology aid the develop-

(Continued on Page 76)

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(Continued from Page 75)

ment of stored program control and the Integrated Services Digital Network?

Mainly by providing lower cost electronics. The major thrust in electronics technology today very-large-scale integration (or VLSI), lowers equipment costs by putting more components on a single chip. Lower costs also result from the very high-speed operation of tightly packed VLSI circuits. The shorter the distance that signals must travel through the components of a microprocessor, for example, the faster it operates and the more work it can do. Although VLSI doesn't give you much technical capability that can't be provided by large-scale integration (LSI), lower-cost electronics means more memory and intelligence can be used in the network.

As to the digital network, VLSI and LSI are well matched to digital functions. A high-quality digital logic gate, the basic building block of all digital systems, cost a few dollars 25 years ago. Today, a quality logic gate costs only a few tenths of a cent, sometimes less. A cost reduction of this magnitude cannot help but widen the field of applications for digital systems and hasten the evolution of the integrated services digital network.

What new services and systems might be made possible by VLSI?

In the realm of telecommunications, there's a whole spectrum of things that have been conceptually possible for a long time, but which low-cost modern technology is only beginning to make feasible. For example, we live in a time when energy usage is critical and will become even more so in the future. Microelectronics and communications technologies together offer significant potential for energy management. Turning lights and other kinds of electrical equipment on and off in homes and places of business in an intelligent way is a simple task for microprocessors.

They can also monitor doors and windows to provide security for lives and property. Microprocessors easily connect to communications links to centralize surveillance and control. There's also the opportunity of associating telephone lines with television sets to call up and display text and data. These examples just skim the surface.

So I think the tremendous potential of VLSI is that it can put complex electronic systems at the disposal of people who couldn't previously afford them. This potential has caused what we call the microelectronics revolution, and it, in turn, has introduced us to the information age.

How have advances in computer-aided design fostered the development of VLSI?

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Well, perhaps it should be stated the other way: The development of VLSI has fostered the use of computers to aid in designing circuitry. The reason for this is obvious. VLSI chips, with hundreds of thousands of components per chip, are already being produced in large numbers, and we're clearly going to up that component density to a half million and probably a million or more.

If you have a million components on a chip, you'll need two to three million interconnections between them. All that "wiring" must be put on the surface of the chip, and it won't work unless every connection is right. The only way you can design at this level of complexity and be sure the resulting device will work is with sophisticated computers.

Don't get me wrong. It's still the people and not the computers who are the real heroes.

You said that hundreds of thousands of components per chip isn't the end for VLSI — there is a step beyond. What are we doing to go this extra step?

VLSI is part of a continuum. The number of components we can put on a chip has been doubling each year since the integrated circuit industry began around 1960. We went from a few components per chip, to tens of components, to hundreds and thousands of components. As a matter of fact, the progress has been so fast that there isn't a common definition of LSI and VLSI.

What comes after VLSI is yet to be determined, but let's assume that it's going to start at a million to 10 million components per chip. We'll need new technologies to reach these densities, and we've been working on them. One of these is X-ray lithography, which lets us produce even finer features on a chip than are possible with some other technologies in general use.

We are arriving at the point where the wavelength of the light used to trace a pattern on an integrated circuit chip is too long compared with the small apertures in the masks used to fabricate these integrated circuit patterns. X-rays have very short wavelengths, so by using them to expose a pattern on the silicon surface, we can extend the limits of lithographic techniques.

We have also developed electron beam techniques for preparing the lithographic masks needed to define circuit patterns. These techniques use very fine beams of electrons to "write" a pattern on the lithographic mask. In the future, this technique may be used to write patterns directly on the surface of the silicon chip, avoiding the need for masks altogether. Using electron beams to write directly onto silicon, we may someday produce circuit densities 10 to 100 times greater, maybe more, than we are capable of producing today.

In the past, silicon processing largely depended on the use of liquid chemicals. New "dry" processes are allowing us to define increasingly fine circuits that would be difficult to fabricate with "wet" chemistry.

In these and other areas of silicon processing, we are making great progress, as is the rest of the industry. And I expect that complexity per chip will continue to grow for some time.

Advances in microelectronics have done much to further the application of computer technology to the network. But what of the software that makes computers do what we want them to do?

Progress is being made toward developing a science of software, but I think a good deal of this progress is in our attitudes toward the science. Software science may not conform to established notions of what a science is.

Will insights into the fundamentals of software lead to analytical breakthroughs of the kind we have had in the physical sciences? Maybe, but I'm skeptical.

But there are other questions we can ask about a science of software: Does software design have a regimentation, established procedures, approaches that can be documented? Can people be trained to design software by other means that an apprenticeship, a close working relationship to an expert? Can you teach software design using textbooks?

The answer to all these questions is yes. We have new employees right out of our colleges and universities who can go right to work designing software. So we must have a science of software, although it's not as analytically powerful as we would like, nor is it yet helping us to make great strides toward improving programming productivity. This is unfortunate — the world needs more software.

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FORECAST '81

THE ERA OF MASS MARKETING

Observers in the computer industry have foreseen for some time that the fastest growth sectors for the next two or three decades will be those involving what the mainframe manufacturers call the intermediate and small machines.

While the next few years will see leading positions established in the mass marketing of such machines, it is the next two years or so that will tell us much about who is going to lead — and how.

There can be little argument about some aspects of the long-term trend. Recent statistical reports (including International Data Corp.'s *EDP Industry Report*, May 1980 show) the decline in the number of general-purpose computer systems in use in the late '70s and reveal less than 20% annual growth in revenues from this sector for the large mainframe companies as a group.

In contrast, "small business" and "personal" computer sectors have grown more than 30% per year. Reputable analysts project industry sales of several billion dollars per year for the small systems market by the mid-'80s. Anticipations of greater growth in the area of smaller machines are rapidly being confirmed, and we see this process as a fundamental change, or evolution, in the nature of the computer industry.

It is important to keep in mind how the driving force behind this evolution, progressively lower costs per function, affects market development. Picture the increasing uses of DP as an expanding cone of development in which new sectors are steadily and progressively penetrated.

Just as steam, diesel and electric "prime movers" gradually spread beyond the central mills, factories and utilities where they were first employed, computer power too is disaggregating and spreading outward to millions of small niches in the economy.

In large corporations, for example, the movement is outward from the central computer site to the offices, factory floors and warehouses. On the national economic scene, computer power is emanating outward from the 50,000 firms with annual sales of more than $5 million to the more than two million companies with sales of less than $5 million. And within this small business sector, the movement is trickling down from the larger businesses to the smaller ones.

Beyond the small business market are 70 million households as yet untouched.

A change in product marketing characterizes this evolution as it has evolutions in other industries. Commercial refrigeration units are engineered and sold with considerable man-hours per installation, while household refrigerators are mass-marketed. Similarly, we are clearly headed toward the mass-marketing era of the data processing industry.

The Next Two Years

Retail stores are the primary mass-marketing outlet in our economic system. But they are not now and will not be in the future the only means of selling small computer systems. Many DP products will be incorporated in other consumer goods such as automobiles, video recorders and cooking ranges.

Nevertheless, companies are lining up on, or just breaking across, the mass-marketing/retailing border. Who are they and where are they headed?

Vendors are surging toward the mass market from every quarter of the industry and from some quadrants not previously recognized. We will touch only some high spots to illustrate directions of activity.

Two Approaches

Only two mainframers — IBM and Control Data Corp. — have signaled a clear intent to get into DP retailing. Their approaches differ as much as their companies.

IBM's approach might be termed the top-down, manufacturer-controlled approach. Coming from the general-purpose mainframe quadrant, the company has been moving toward the retail market with the downward extension of its product line, its 25 business computer centers and its new store in Baltimore. Rumors in the industry suggest that thousands of retail outlets will follow.

One can be reasonably confident that IBM plans to sell IBM products, IBM networks, IBM software and IBM "solutions" in these stores. IBM's penchant for market control seems likely to extend as far as it can go. While control of small business users seems unlikely, control of the product lines in tightly organized outlets is clearly feasible — and expected.

Following the wave downward from the high end, IBM is not visibly oriented to the "personal computer" market as yet.

CDC's approach tends toward a "services supermarket" concept. The company will not be selling CDC hardware as much as it will sell CDC services. Its concept for the 100 or so outlets envisaged seems to be to offer businesses a range of services including credit, management counseling and a variety of hardware and software management tools and aids. CDC considers itself a system integrator on behalf of the small business client.

Xerox Corp. enters the scene from the high-technology portion of the office supply spectrum. The company is pioneering what might be called an "office hardware supermarket" approach, offering copiers, small computers, staplers, paper clips and so forth. Xerox has gone to the extreme of selling a non-Xerox wet copier in its efforts to offer a full range of office equipment.

These large companies are similar in pitching their current campaigns at the retail business supply store level rather than at retail stores for individual customers.

Mini Makers

Minicomputer manufacturers are active in the marketplace, but Digital Equipment Corp. and Data General Corp. are taking different routes.

DEC, like IBM, seems to approach the store market from the top down, with manufacturer control. DEC's rapidly growing stores are also in the business supply store mode.

DG apparently foreswears control of the retail outlet, but clearly sees the need to push its product line down to the size and expense categories that can be handled by such outlets. DG has a large distributorship now, and the company plans to bring some of the amenities of the larger systems to the small systems market.

DG hopes to assemble products with sufficient potential for modification that they can be tailored to a variety of marketing channels, including specialty marketers. Precisely when DG will penetrate the under-$5,000 market is not known, but it probably will not be in the next two years. But the company, aware of what the discount stores have done to the traditional department stores, appears to understand the need to protect itself on the underside of the market.

Dan DeLay, a product line manager in DG's General Distribution Division, projects a strategy in which the manufacturer builds and orchestrates a complement of capacities in hardware, language choices and general program products (such as report generators and word processing plus particular application programs) and then exploits the capacities of various independently owned marketing channels to "tune" these capacities to the requirements of multitudinous market niches — doctors, lawyers, warehouses and so on.

Ohio Scientific in Aurora, Ohio, exemplifies the company that takes a fling at its own outlets, but eagerly opts for a place in a larger company's network when given the chance. Such probing opportunism may be repeated in this area more than once over the next two years.

Keeping Old Ties

The established mainframe and minicomputer firms that venture into the mass market will not abandon their contacts with corporate hierarchies or their one-on-one customer contact systems. Larger equipment sizes require such contacts. Contacts at the corporate level are also, as IBM knows, a way of moving large quantities of smaller equipment to divisions and branches.

Rather, the stores are a means of extending the marketing spectrum. The companies make a clear distinction between large-firm and small-firm buyers and are aiming their store outlets at firms in defined size brackets. One company defines the size as less than 20 employees, another as more than five employees. Interestingly, one is already looking at the office in the home.

The word processing vendors are out there at the "business supply store" level. One can see in their offerings a clear intent to provide as much of the full complement of office DP services as can be extracted before others soak up the available office space. We do not, however, see these companies creating owned chains of retail stores of the Radio Shack gender in the near future.

And then there are the newcomers to *Datamation's* top 100, such as Apple Computer, Inc., Commodore Business Machines, Inc. and Tandy Corp. (Radio Shack), which sell the smaller variety of desktop computers. Of the three, Tandy most clearly illustrates the bottom-up approach. Working from an established network of consumer stores, Tandy first aimed at the personal market, but quickly raised its sights. Some in the computer industry may have misinterpreted this shift. Tandy has no more abandoned the personal computer market than IBM has abandoned mainframes. It is simply extending its line.

Spreading Like Crabgrass

What can we say that the stock market hasn't already said about the success of the companies coming into the market? They are spreading retail outlets like crabgrass, and the sales charts will show steep angles of ascent for at least the next two years.

While the success of the bottom-up

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Claude Ryo Shirai is president of Washington Nichibei, Inc., a research firm located in Washington, D.C.

The authors wish to express their appreciation to Steven R. Ratner, a student at Princeton University who furnished valuable assistance in assembling data and otherwise preparing this article for publication.

FORECAST-81

By C. Jack Pearce and Claude Ryo Shirai

firms is now obvious, it took Radio Shack's demonstration of the timeliness and feasibility of the retail store concept to prove it. These mini-micro firms constitute a cutting edge as real and as important as the latest supercomputer architectures, though on a different scale.

While the DP industry is feeling its way toward productive combinations in the still *terra incognita* of retailing, retailing itself is a very old art. One can use some of retailing's history to predict the future of DP mass marketing.

First, there never has been any shortage of people to set up and run retail stores. Many of these people, as Xerox knows, can be recruited from existing retail establishments.

Without much impetus from manufacturers, the DP retail marketplace is already populated by hundreds of small, family-owned stores, a few small franchised chains, a few somewhat larger chains of company-owned stores and Tandy's big net.

If DP and marketing histories are reasonable guides, the next two years will see a 25% or more increase per year in the number of stores.

Second, the "chain" phenomenon, in which local management and often local ownership are married with standardized organizational forms and centralized support services, pervades U.S. retailing. This pattern is therefore highly likely to play a large role in DP retailing.

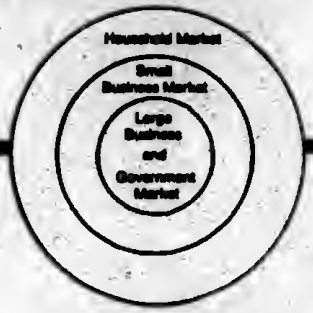
Franchised systems, one major manifestation of the pattern described above, are endemic to our retail scene. Notwithstanding early difficulties, we expect franchising to become a major factor in DP marketing. We expect some small franchised chains to grow rapidly and new ones to spring up over a two- to three-year period.

Third, the retailing chain more often than the manufacturing facility has become the organizational focus, the center of gravity. The result is that retail outlets carry multiple lines of manufactured goods. We would expect this trend to surface in DP retailing as well, and Xerox and CDC already reflect this market dynamic.

Fourth, systems personnel ought to look at retailing as a learning curve situation. Some already do.

For the manufacturer, some elements of the learning curve include optimum mixes of hardware and software and optimum vendor support techniques.

For those in the stores, elements of the learning curve include inducting large numbers of personnel without technical backgrounds, gaining familiarity with new hardware and software, acquiring some form of service support, learning effective forms of advertising and other sales generators plus mastering small business management.



Concentric Circle Chart
Of U.S. Computer Market

The learning curve can be accelerated by recruiting people with retailing experience at all levels of DP mass marketing, from manufacturing to chain organization to the outlets. Those experienced in retailing already understand much of what the DP industry needs to learn.

Beyond the learning curve of the industry — but linked to it — is the learning curve of the users: the small business and household populations. Those in the computer industry are accustomed to steep slopes in the learning curve; there is no reason to expect otherwise in the mass market. Accounting, inventory, billing and similar applications constitute much of the near-term growth. Educational and entertainment materials have growing markets as well.

There will be experimentation, trial and error. But a growing market has some forgiveness built in, and considerable trial and error can be survived.

Last, we should not overlook the persistent survival of specialty stores, which invariably coexist with chains and general-purpose stores. Software houses are visible today at the retail level. Specialists by business user category are also visible. So we can expect to see more of both DP department stores and "boutiques."

Product Characteristics

A consensus on certain important characteristics is emerging from the action and statements of those nibbling at the mass market for DP equipment. That consensus emphasizes simplicity of use, the provision for prepackaged training, minimal use of one-on-one training techniques, high reliability, upward and downward compatibility, stand-alone and networking capabilities, communications capabilities and interactive capability.

Many equipment vendors and marketers seem determined to avoid the hand-held calculator syndrome, that is, ever-cheaper hardware and no substantial software sales. Our contacts indicate strenuous efforts by those contemplating this market to create and maintain a broad range of software products with each significant hardware introduction and to market the software in integrated, additive packages. Business software packages are the standard types expected: accounting, billing, inventory control and the like.

This, of course, has created an independent software industry which will flourish with the market as a whole. Manufacturers will have numerous software make-or-buy options.

Vendors in the $500-to-$5,000 computer market today seem to be climbing up the computer size and capacity ladder as rapidly as — or more rapidly than — those who are starting from higher levels and coming down the size ladder.

These small system vendors, who can read the history of IBM as well as anyone else in the industry, know the advantages of covering a broad range of needs with a compatible product line. They have every expectation of building into their machines scaled-down versions of all the nice things about today's mainframes — memory management systems, networks, remote data entry and more.

While the DP industry is feeling its way toward productive combinations in the still terra incognita *of retailing, retailing itself is a very old art. One can use some of retailing's history to predict the future of DP mass marketing.*

Today Radio Shack is offering reasonably sophisticated small business systems for less than $10,000. In two years Tandy and other companies will be able to produce systems and software usable by companies the general public would not perceive as "small."

The "small" image of stores and small systems — and lack of user knowledge or assurance about the rate at which the equipment and support systems can and will grow in capacity — probably limit the retail store sales to businesses more than the latent capacity to service substantial business needs. We can expect to see Tandy and others make vigorous efforts to lift the public's expectations concerning their product lines in the immediately foreseeable future.

Some Notes on Strategy

Each set of manufacturers faces a stringent product and distribution system expansion test in the next two to five years. The mass market, like other battlefields, will go to those who get there "the firstest with the mostest."

We do not think that the traditional industry leaders will necessarily be first often enough to preempt the retail area. The rate at which the industry giants can generate new products and get them into the small business fields in their initial mass-marketing forays will tell much about their eventual market placements and market shares.

Small systems manufacturers face a difficult choice. They can try to fathom the mass market and control their placements in it, or they can manufacture products and accessories and assist others in tailoring an array of components to a spectrum of user needs. Both strategies will be used in the next two years, although the second may have more takers. Which will be more successful cannot yet be determined.

Company store? Franchise store? Independent distributor? These will be key choices and decisions for suppliers. Our prediction is that franchise and company store systems will spread most rapidly. We expect to see several new franchised systems in the next two years. Such franchised systems will create opportunities for a variety of manufacturers and software suppliers. Alert suppliers might do well to assist in developing franchised retail outlets. One cautionary note: Not all of the new chains will survive.

Broader Base

DP suppliers, of course, should not limit their thinking to computer stores. The efforts of Xerox and CDC demonstrate that broad-spectrum retailing concepts will probably play only one role in DP retailing. These broad-spectrum approaches will probably coexist with price unbundling of numerous products and services such as education and training.

Companies positioned to enter the DP mass market would do well to work through the problems of retailing as they would any other investment. Harmonizing manufacturer-retailer expectations, defining the necessary retail support services, constructing retailer-manufacturer feedback mechanisms, determining the kinds of personnel needed to succeed at the retail level — these are parts of the larger combination that will unlock the door to a bright future.

We believe the bulk of the computer industry is underestimating the mass market for DP products and is not yet fully conscious of the requirements for mass-marketing DP. Several million businesses and vastly more households can best be tapped only with sales approaches combining reliable, easy-to-use products with low costs per contact.

But perhaps this underestimation is not all bad. After decades of overexpectation, not to mention hype, some modesty in vision and expectation is refreshing. The nation's consumers need not fear that they will be neglected. Some newcomers to the computer world are showing great adeptness at building mass-marketing foundations. And were we not to do so here in the U.S., the Japanese would find a way.

The next two years will show who has the vision and the capacity to get in on the ground floor of DP's mass-marketing era. Those who are equal to the task have a long and interesting run ahead of them.

EDITORIAL

Risky Business

Making predictions is a risky business. As Bob Glass shows on Page 4, in a story loaded with a megabyte or two of humor, even the best minds in the business have been wrong. Sometimes they've been *very* wrong.

But *Computerworld* is dauntless. As we do every year in the annual "combined issue" (Dec. 29-Jan. 5 this time), we've cast sidelong glances at events in the past year, then bravely put down some forecasts for the future. Our predictions are pretty much short-term, but we hope you enjoy them and find them useful.

And we hope Bob Glass won't be writing about *us* next year.

LETTERS

'It's OS!'

Our corporation is making the conversion from DOS to OS. In keeping with the holiday spirit, one of our programmer/analysts composed these verses to the old favorite, "Let It Snow." We thought we would share this composition with *Computerworld* readers.

Programming and Analysis Staff
American Family Insurance Group
Madison, Wis.

It's OS!

Well, our software we're converting,
If it bombs, we'll be reverting.
It really could be a mess,
It's OS! It's OS! It's OS!

Oh, we know there's trouble brewing,
'Cause we don't know what we're doing.
Our JCL is a guess,
It's OS! It's OS! It's OS!

When we finally get it right,
It could very well be July.
We'll have to work day and night,
Getting the system to fly.

Oh, the problems are never-ending,
The programs keep abending.
We really can't take the stress,
It's OS! It's OS! It's OS!

— Mike Sharpe
(With apologies to Sammy Cahn)

Look at 'the Facts'

It was with some amusement that I read the letter from Donald Weimer in the Dec. 15 issue. He quite properly pointed out that one could store four six-bit characters in three eight-bit bytes. Then with a literary wave of the hand he alluded to a "slightly fancier method" that would be required to pack the fifth character.

Let's examine the facts. If you have an alphabet of 40 characters, and five character positions, then you can construct

$$40^5 = 102,400,00$$

different "words." You have 24 bits to store all this data, but that only allows for

$$2^{24} = 16,777,216$$

possibilities.

No encoding scheme, however fancy, can uniquely map 102 million symbols into 16 million. On the other hand, if you restrict yourself to 27 characters, then you can construct (only)

$$27^5 = 14,348,907$$

different "words," which *will* fit into 24 bits. The algorithm for packing is straightforward, obvious and probably useless.

Hanley A. Strappman
Marlboro, Mass.

How About the User?

Werner Frank did an excellent job of reviewing a key area hampering data processing productivity — software maintenance [CW, Nov. 24].

However, his suggestions for containing the "maintenance monstrosity" prevalent in all programming departments fell short. His suggestions centered around DP solutions to the problem. What about the user? System development must not only include users from an operational perspective, but also from a maintenance perspective.

User involvement is not a new concept. User-oriented report writers have assisted in breaking the programmer bottleneck in generating and modifying computer output. Why shouldn't the same concepts be applied to certain aspects of systems maintenance?

Working for a software vendor, I am pleased to say we practice what we preach. For more than 10 years we have been developing packaged software that involves the user in both system operation and maintenance as much as possible. In fact, our recently released product, called Dataryte, enables the oser to create and maintain application system edits. Historically, thorough editing was either impractical or required excessive development time and expense. Dataryte provides a vehicle for improving the quality of system edits and it is table-driven which allows the user to establish and change edit criteria.

Even though software maintenance is here to stay, let's find ways to enlist non-DP personnel to carry some of the work load.

Ray Possehl
Director, Sales & Marketing
Generated Systems, Inc.
Wheaton, Ill.

Deadly Sin

"The Menace of Micros" By David Stevens was very well done, and I thought it worthwhile contemplating his thoughts.

It may be a paradox that one of our seven deadly sins may save us — pride!

Most people I know love to brag. What's the use having the tailored suit of clothes, the latest terminal in your bedroom or the latest rubber dolly that talks, looks and feels like human and says and does only what you want (even the oldest profession may be on its last legs) — if you can't brag about it to someone?

I don't think human egos are strong enough — at least in humans living in what we call "highly civilized" technical countries — to do without ego support from other humans. Computers can't do it. They're not and never will be "built right" for that.

Ray Russ
Fairborn, Ohio

Computerworld welcomes comments from its readers. Preference will be given to typed, double-spaced letters of 150 words or less. *Computerworld* reserves the right to edit letters for purposes of clarity and brevity. Letters should be addressed to Editor, *Computerworld*, 375 Cochituate Road, Rt. 30, Framingham, Mass. 01701.

DATA PAST

Five Years Ago
Dec. 31, 1975/Jan. 5, 1976

SEATTLE — Several months after two contenders for a facilities management contract effectively knocked each other out of the running, Seattle accepted surrounding King County's offer to share its DP facility for three years — free. The offer was almost too good to be true, and skeptical city officials were at first reloctant to accept it. "There's no such thing as a free lunch," Councilman Randy Revelle was quoted as saying in the local press. With the offer, Seattle hoped to lop $300,000 off its projected 1976 DP budget of about $5 million.

Ten Years Ago
Dec. 30, 1970/Jan. 6, 1971

TORONTO — A debtor's data bank was being assembled under the auspices of the provincial Department of Justice. Scheduled to be completed in three years, it would provide information to anyone for a $2 per search fee.

— — —

NASHVILLE, Tenn. — Several, perhaps hundreds, of Internal Revenue Service computer tapes containing thousands of tax records, erased by airport radar last spring, had yet to be restored. Inadequate grounding of metal shielding was cited as the cause of the wipeout.

READER COMMENTARY Bill Scott

Users Must Share Blame For Many 'Horror Stories'

Data processing magazines are ablaze with articles detailing lawsuits set in motion by disgruntled consumers against "unscrupulous computer vendors." Everyone seems to be placing the blame only on the heads of those vendors.

Is that where the basic fault lies? Certainly not! Look around you. Automobiles that stay in the shop more than they stay on the road. Clothing that rips at the seams under the slightest strain. Throw away this, disposable that, shoddily made merchandise that looks great on the shelf, but is worthless in use.

Somebody has finally spotted this trend in the DP business. What made anyone think DP was immune?

I can remember when you could drive a car into a wall and it still resembled a car. I can remember watches that ran for a full year without running backwards. We as a competitive people have all assisted in creating our 20th-century "Junk Society." The American populace as a whole shares total responsibility for establishing and supporting our highly competitive environment.

We have all had to learn the hard way that you get what you pay for; however, great throngs of computer purchasers persist in trying to beat the system, only to find themselves in the trade magazines a short time later, screaming "foul, foul, foul."

All over the country, computer salespeople are being armed with systems that are barely adequate to run a convincing demonstration and people are buying them as if there were no tomorrow. I am reminded of the Indian chief who returned from surveying the resources available to his tribe during the coming winter storms. "I have good news and bad news," he proclaimed. "The crops are dead and there's nothing out there to eat but buffalo chips."

"What's the good news, Oh Great One?" cried a warrior. The chief replied, "There's plenty of buffalo chips."

When Phineas Taylor Barnum said, "There's a sucker born every minute," I think he was talking about us!

Stop and Listen

So many of us refuse to learn from the experiences of others. The subject of computerizing a business is so complicated and the jargon so esoteric that the businessperson is like a helpless animal being pursued by a well-armed safari. So before you become another horror story among a cast of thousands, stop and listen to the animals.

My company specializes in the petroleum market, and I am amazed that the primary concern of the majority of our prospective buyers is "how much"

(Continued on Page 88)

THE TAYLOR REPORT/Alan Taylor

Sites Can Choose Software First

Would any computer installation want to choose its software *before* knowing the hardware on which it was to run? And, if they would, then how would they fare in the 1981 marketplace? In short, *could* they do so and reverse the traditional process?

Well, one DP department wanted to and did. Recently, after I had been writing about transportable software without giving real histories, this department told me about its experience. Transportability was the key.

The company, a chicken producer, needed sites in various locations for a distributed system that would look after each chicken farm. There were two reasons the company wanted to choose its software first:

1. To ease the service problems.
2. To allow the best choice of hardware when expanding the system after it was programmed and operational.

Service Problem

The problem with service is obvious. Even with Hewlett-Packard Co. and its new maintenance guarantees, many systems need to watch uptime — or rather *downtime*. And downtime varies not only with the hardware, but also with the distance from service centers.

It just doesn't make economic sense to choose Hardware A over Hardware B when A is generally better, but some sites may be 50 miles from A's service station. Nor does it make sense to choose B over A when A is better and can properly service *most* of the sites.

Finally, it is not even reasonable to select both systems to get the best service possibilities at the cost of having to develop and maintain two separate sets of parallel software.

The solution — transportable software — did provide the best service capability, while requiring only one software development effort. So transportable software was chosen first.

Fast-Improving Systems

The future value problem this DP installation faces is not as obvious as the service problem is. Service problems are still universal, but only in the mini and micro areas is the explosion of vendors of good solid equipment making it practical to expect improved cost/benefits and facilities every two months or so, instead of about every two years.

This situation mainly springs from the nature of distributed processing and the variety of hardware vendors offering related pieces of 8-bit, 16-bit and, coming shortly, 32-bit computer architectures.

As these naturally don't all hit the

(Continued on Page 86)

READER COMMENTARY/Richard Van Tassell

The Lowly GOTO Defended

When Edsger Dijkstra disparaged the use of the branching statement (GOTO) in programming, he started a controversy within our profession which has raged unabated ever since. Perhaps it should be observed that neither Dijkstra nor anyone else has ever maintained that a correct program with GOTOs could not be written. What Dijkstra said, in essence, was that he had observed that competent programmers use relatively few of them. "Relatively" is the key operative word here.

After this pronouncement, various programming zealots, in their efforts to bring order out of chaos, have maintained that programs can be written without GOTO's. Some insist that a "structured" program should contain no GOTO statements. To date, however, there is no consensus within our profession as to just what constitutes a structured program. Each practitioner has a different idea of what that means.

Most of us apply the term to the creative process of programming, as well as to its end result, the program and its documentation. Indeed, the word is a treacherous one: for anything that is not random is, therefore, structured. Every computer program is structured, if one applies this last yardstick, no matter how poorly.

Nearly every statement in every programming language has implicit GOTO. To where? To the next statement, in "lexical" order; that is, the next one immediately after. A sequence of statements is, of course, implemented by these implicit, or understood, GOTOs whenever an explicit branching statement is absent.

Not Prohibited

Several authors in our field have written clearly and lucidly about structure in programming. Myers, Orr and Constantine have given us outstanding material. None of these writers prohibits the use of GOTOs as a condition of structure. Common sense also argues against such a prohibition, in my experience, for several reasons:

Some iterations ("loops") are so simple and obvious, and occupy so few lines when coded, that the use of a GOTO to get from the "bottom" to the "top" of the loop seems preferable to a PERFORM UNTIL from the standpoint of clear documentation, even if execution efficiency is no greater. The listing of a short Cobol loop implemented with a GOTO conveniently shows the statements to be executed in-line, right within the loop of which they are actually a part, rather than off in a closed subroutine in another part of the listing.

Second, a GOTO may very well be the method of choice or the only method to get from within a module, or performed procedure, to its labeled exit statement (so that it can return control immediately to its caller). This works well from a documentation point of view, for it proclaims: "As much of this procedure as it is necessary to do has already been accomplished."

Cobol's exit statement cannot readily take the place of such a GOTO, because, among other things, it cannot be conditioned with an IF clause and must be the only statement in its own paragraph.

Awkwardness Overcome

There are awkward syntax features in other programming languages that are easily overcome with a GOTO. For example, every RPG programmer knows that it is simpler to "branch around" a larger number of calculation statements that would all have to be conditioned upon the same indicators by simply conditioning one GOTO statement upon the logical negative of those indicators; with the target "TAG" being just beyond that group of statements, lexically.

Finally, the GOTO is undeniably useful in implementing a "case" structure, particularly in Cobol. Perhaps Cobol should offer a PERFORM statement with a DEPENDING ON option, but so far it doesn't. What is offered, by our compiler, is the DEPENDING ON option of the GOTO statement. Long series of IF clauses are often avoided by using the DEPENDING ON option.

GOTO statements do not necessarily detract from the quality of the programs we write, although their unrestricted use could very well have that result. In the Cobol programming of our firm, we have been very well served by several rules we have adopted as programming standards. They were designed to promote "structure," readability and maintainability, and the GOTO statement is an integral part of them.

Procedural Standards: A program is designed first, then pseudocoded, charted hierarchically, then coded. Test data is designed, created and tested. The program is then tested and debugged, using the test data. There is peer group review of each step of this process, and the completed documentation for each step serves as the basis for the review. Formal approval of the group is required at each step.

Module Naming Standards: Cobol modules are numbered in such a manner as to be in alphanumeric order within the listing. They are English-named also. The procedure division is not sectioned (unless a declaratives section is required, in which case the remainder of the division is coded as a single section). Therefore, all procedure-names are paragraph-names. The figure on Page 85 illustrates these points and a number of others yet to be made.

The top module of this program is named A10M-CREATE-MASTER-TAPE. The first letter identifies its

(Continued on Page 84)

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PRIME
Computer

Use of GOTOs Can Keep Programs' Structure

(Continued from Page 81)
level, A. It is the only module at this level. Each other, lower level module is named so that its first letter is one letter, alphabetically, beyond that of its lowest level caller, and the module is placed accordingly in the source code. Adherence to this rule assures that recursion, which is prohibited by the compiler, will not occur; that is, a module will never call itself, either directly or indirectly.

In addition, the hierarchy of modules is clearly indicated by these level designations, whether or not one happens to be looking at the hierarchical chart of program organization.

The second character is a number which, along with the first letter, is carried throughout the module. A1, for example, identifies each paragraph of the mainline module of the figure and, accordingly, identifies the module itself.

The third character is another digit, this one being chosen as required to cause paragraph-names to "ascend," in alphanumeric sequence, throughout each module and, for that matter, through the entire procedure division listing. The value of this rule in enabling paragraphs to be found quickly in the listing is obvious.

The fourth character is chosen from an "installation standard" list and used to describe the function of the module from a "data processing" point of view. For example, "M" is mainline, "R" is read, "X" is exit and so forth.

Module Names

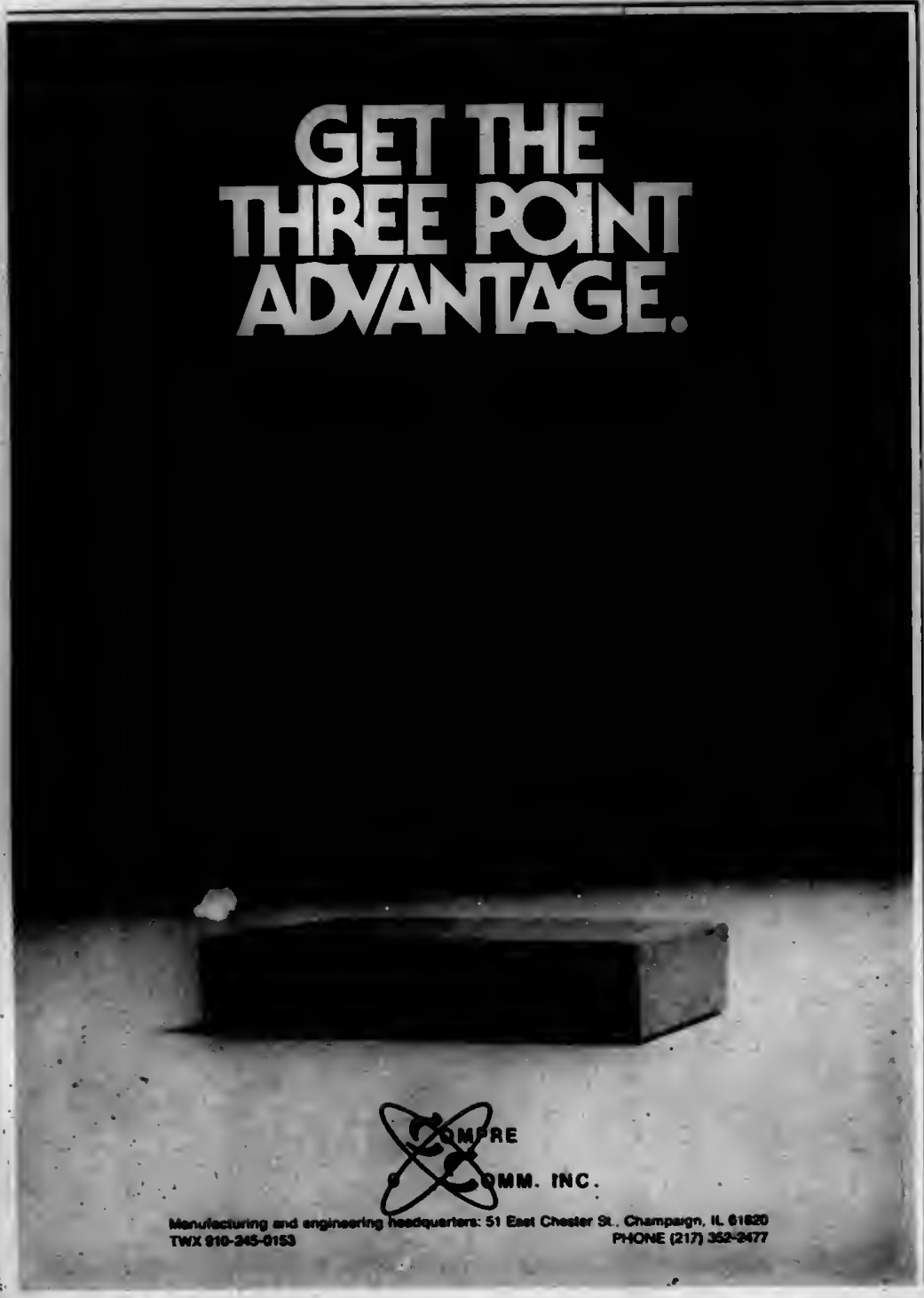
Finally the module is named in English, to complete the paragraph-name. Our staff puts forth considerable effort in choosing the English portions of module names, as well as the names of their internal paragraphs. We have found that the descriptive quality of these names is often crucial to the quality of the program and to the success of subsequent maintenance.

Briefly, the name should correctly describe the single function which is to be accomplished by the module, in a way not permitting misinterpretation. If such a name cannot be chosen, we conclude that the module, as conceived, lacks what Myers called "functional strength"; and so, we redesign until we achieve module(s) perceived as single-functional by the peer group.

In this connection, we have noted a tendency on the part of the programmers to name a paragraph in honor of what has already been accomplished at the point at which execution begins, rather than for what the paragraph itself is to accomplish. This is a natural enough tendency, and it results from the sort of thinking that goes like this: "If we got to here, then it was because such-and-so is true . . . or was done." This thinking, even if correct in any particular instance, would be irrelevant. It would be like naming each book on the library shelf for the contents of the book just to the left of it and would lead to confusion.

Each logical module has two or more named paragraphs, the first of which is also the module-name. All except the last one of these contribute to the purpose of the module, while the last is the exit paragraph and contains only the exit statement. The method of naming an exit paragraph is to let "9X" be the third and fourth characters of the name, followed by "-EXIT." The choice of "9X" allows the exit paragraph's name to be in alphanumeric order with the remainder of the module's paragraph names when it is placed at the end, lexically speaking.

Coding Standards: Whenever a module's purpose has been demonstrably accomplished while the "next statement" which would otherwise receive control is somewhere in mid-module, a "GOTO exit paragraph" statement is in-



"I Sure Hope That's Hard"

and Readability Intact

serted.

This exit-paragraph technique is combined with the use of PERFORM statements with the THRU option, the second procedure-name referring always to the exit-paragraph of the performed module. In the example, paragraph A11 of the mainline calls B3 with this type of PERFORM statement, and B3 similarly calls two C-level modules.

The limits of each logical module are made obvious by these techniques. This is true whether one is looking at the code of the module itself or the code calling it.

Because the exit paragraph and its associated exit statement always mark the end of a logical module, new statements and indeed, new paragraphs (except at the very beginning) can be added, changed or removed within a module without changing the limits of the module as viewed from an "external" point. This is a valuable feature of the method, for it allows the programmer to concentrate on the immediate code requiring debugging, improvement or change.

GOTO EXIT PARAGRAPH statements will be part of this unchanging code if they are not immediately involved in the change, but are somewhere else in the module being revised. The same cannot be said of the alternatives, which would, generally speaking, involve nested IF statements, sometimes in very deep and hard-to-follow nestings.

The objective of this article has been to show, by actual example, circumstances in which the GOTO statement promotes the readability and maintainability of programs, while doing no violence to their structured quality. It is to be hoped that all will recognize the GOTO for what it really is: a tool that has its proper uses and can be used properly or misused, just like any other tool. Also, perhaps it might be realized that the "structure" of programs cannot be judged, either qualitatively or quantitatively, according to the mere presence or absence of GO-TO statements.

Van Tassell is the general manager of Rich Industries, a service bureau in San Leandro, Calif.

```
PROCEDURE DIVISION.
A1ØM-CREATE-MASTER-TAPE.
    OPEN XXX XXX XXXXX XXXX.
    .
A11M-XXX-XXXX-XXXXX-XXX-XXX.
    .
    PERFORM B3ØI-GET-VALID-CONTROL-CARD
        THRU B39X-EXIT.
    .
    IF  XXX XXXX XXX XXX.
        CLOSE XXX XXX XXX XX.
        GO TO A19X-EXIT.
    .
A12M-GET-XXX-XXX-XXXX-XXX.
    .
A12M-TEST-XXX-XXXX-XXXX-XX.
    .
A19X-EXIT.
    STOP RUN.

B1ØW-XXX-XXXX-XXXX-XXXX.
    .
B19X-EXIT.    EXIT.
B2ØS-XXX-XXXX-XXXX-XX.
    .
B27R-XXXX-XXX-XXXX.
    .
B29X-EXIT.    EXIT.
B3ØI-GET-VALID-CONTROL-CARD.
    .
    PERFORM C1ØR-READ-NEXT-CONTROL-CARD
        THRU C19X-EXIT.
    IF  CONTROL-CARDS-ARE-AT-END
        GO TO B39X-EXIT.
    PERFORM C4ØS-TEST-CONTROL-CARD
        THRU C49X-EXIT.
    IF  CONTROL-CARD-IS-VALID
        GO TO B39X-EXIT
    ELSE
        DISPLAY CONTROL-ERROR-QUERY UPON CONSOLE.
B3ØI-IMPLEMENT-ERROR-DECISION.
    ACCEPT ERROR-DECISION FROM CONSOLE.
    IF  IGNORE-ERRORED-CONTROL-CARD
        GO TO B3ØI-GET-VALID-CONTROL-CARD
    ELSE
        IF  NOT CANCEL-JOB-WITH-CONTROL-ERROR
            DISPLAY 'WHAT' UPON CONSOLE
            GO TO B3ØI-GET-IMPLEMENT-ERROR-DECISION
        ELSE
            GOBACK.
B39X-EXIT.  EXIT.
    .
    .
    .
```

Sample Code

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LETTERS

Don't Ignore the Facts

I have just seen the article on my paper presented at ACM '80 in Nashville. It was a fair resume of my talk. Naturally, it was a condensation of what I hope had been a closely reasoned and well-referenced paper.

The letter by Reinhard Mirkovich is another matter entirely [CW, Dec. 8]. The first rule of research is to check the original sources. Not only was this ignored, but the quotations from the *Computerworld* article were distorted. What sort of refutation can be based on "guilt by association"? Surely at least one of my arguments should have been countered.

In 1978 I predicted 20% unemployment by the end of 1983 and was exactly on course according to the October 1980 figures. I did not give technology as the only cause of unemployment, but modern technology is installed to increase productivity and quality. Although this may not cause unemployment at that plant, it certainly causes problems for the competition. I quoted the investment of 250 billion yen in high technology by Japan as causing problems for Western automobile manufacturers.

Does Mirkovich doubt that increasing unemployment correlates with increasing crime and vandalism? Check the evidence.

Is there doubt that there is a growing movement seeking strong police powers to obtain "real law and order"? Read the right-wing papers.

Is there doubt that the technology exists to monitor our citizens? The West Berlin audiences I addressed early in October were convinced. They knew the danger.

I can appreciate that the ideas I put forward frighten Mirkovich — they frighten me. That is no excuse for ignoring the facts. Surely, we are entitled to have a properly argued refutation, not just an attack on my integrity.

Robert D. Parslow
Uxbridge, Middlesex, UK

Computerworld welcomes comments from its readers. Preference will be given to typed, double-spaced letters of 150 words or less. Letters should be addressed to Editor, *Computerworld*, 375 Cochituate Road, Rt. 30, Framingham, Mass. 01701.

Choosing Software First

(Continued from Page 81)

market at the same time, competition is severe, and prices drop every few months or even weeks, while worthwhile features (including uptime-increasing diagnostics) improve.

The chicken producer wanted to reap these benefits for its new system. From the company's point of view, transportable software gives a double economic benefit over the standard hardware-first approach, allowing the user to get better equipment later and at lower prices.

The user finally chose Microcobol, a system that currently works on some 30 systems, varying from 16-bit systems like IBM Series/1 to 8-bit gear based on various common chips. In one way, Microcobol seems to be even more transportable than most other transportable products — even the disks themselves can be moved between different systems, provided that the physical characteristics (8-in. size or what have you) remain constant!

The language is familiar to Cobol programmers, although the vendor, CAP-CPP, Inc., has dropped out the identification and environment divisions. Two groups of software support have been provided, for application users and developers respectively. The user runtime facilities include a multiuser operating system (BOS) with standard utilities, optional linkage, security and interfacing capabilities, but without the development facilities of compiling, testing, libraries and debug utilities.

CAP-CPP and various OEMs also provide application programs which, because of the transportability of both language compiler and operating system, can be developed on one system and offered on dozens of others without modification.

With this software choice now made, the chicken producer's application is being developed, although most of the hardware has yet to be selected. Even its fundamental architecture is not firmly known, nor will it be uniform across the system.

In this case, "software first" has been a practical approach. The dollar costs are reasonable (single-copy retail price is $1,500 for the development system and the Multiuse Business Operating Runtime System is $750).

Alex D'Agapeyeff, CAP-CPP's chairman, admits that so far the ongoing development of micros and supermicros has not really impacted most DP departments, bu. he is confident that the effects cannot be long delayed. The existence of a software-first choice may well be the key point that moves other users over.

CAP-CPP can be contacted through Trevor Noble, CAP-CPP, Inc., 521 Fifth Ave., New York, N.Y. 10175 or Kenneth Clark; CAP-CPP, Inc., 299 California Ave., Palo Alto, Calif. 94306.

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HUMAN CONNECTION/Jack Stone

How Good Is Your Personnel Appraisal?

Nearly everyone appreciates the importance of effective employee appraisals, yet most DPers know that the appraisal system is not working wonderfully well in their computer centers.

Part of the problem is that systems managers, as a rule, don't accept the subjective aspects of the performance appraisal, aside from their reluctance to "stand in judgment of their fellow man." Another aspect of the problem is that many senior top executives don't monitor the process in the center because they are fearful that negative appraisals — or at least those perceived by the employee as negative — might just drive some critically needed systems specialist out the door.

Still more of the problem is attributed to the personnel departments which, for one reason or another, haven't imbued (or is it "force fed"?) systems managers and supervisors with the principles and practices of effective performance appraisals.

With this background, it's no surprise that many DPers are reluctant to cooperate fully in the appraisal process. For example, they won't always bring up needs for counseling or additional training, thinking that management will use this information to reduce the coefficients of employee promotability.

Well, several hundred well-chosen words of mine on the subject aren't going to supply the answer, either, but perhaps the thoughts expressed in this and upcoming articles will encourage some readers to become more interested in the subject.

Imperfect Process

To begin with, it is well recognized that personnel appraisals can never be totally objective and appraisal tools can never be totally precise, and this observation is justifiably discomforting. But is this situation anything more than a reflection of the imperfect world in which we live? The fact that human judgment of other humans must enter the appraisal process should not be the basis for its condemnation and for letting its quality slip.

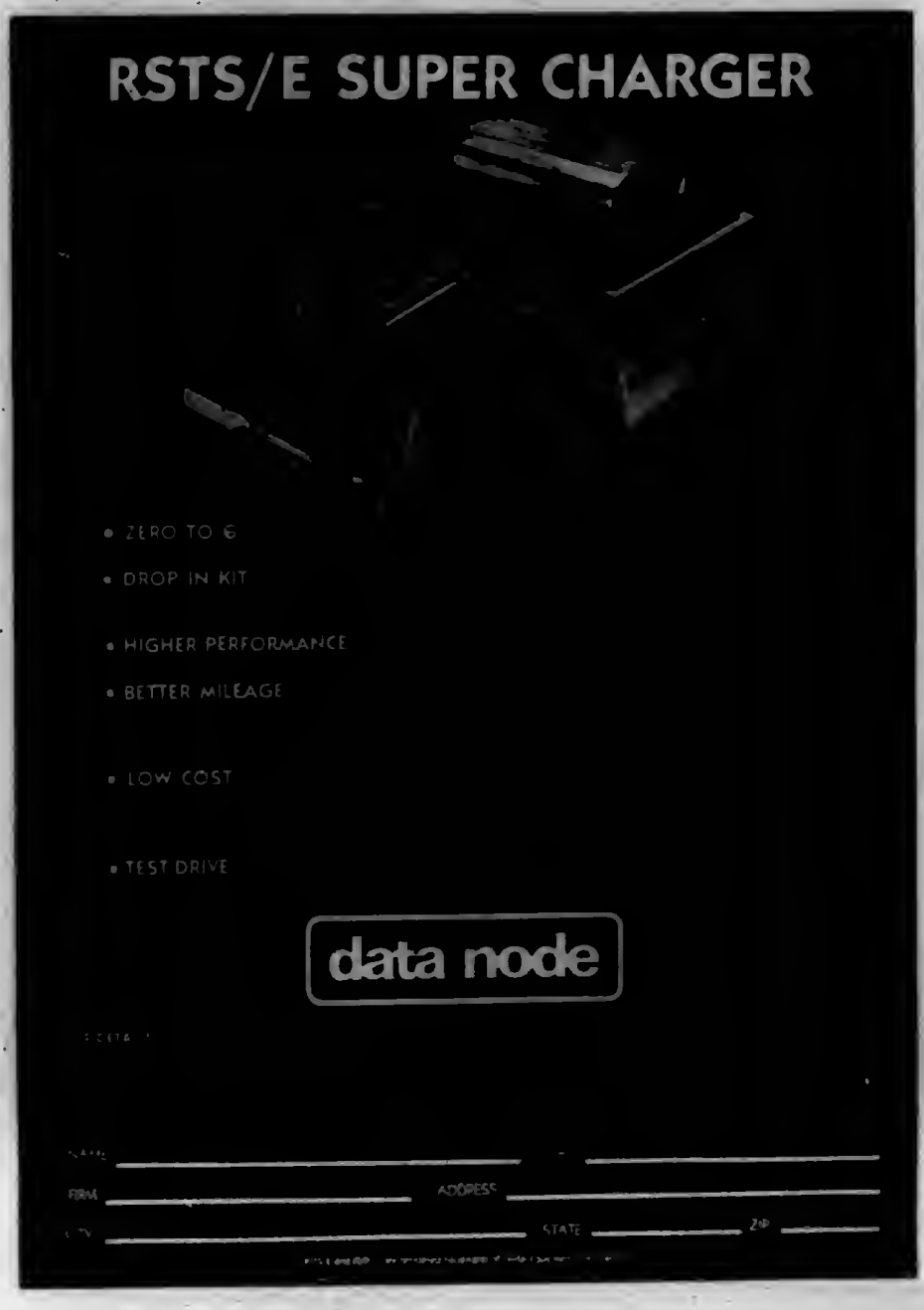
And on the subject of quality, how good is your appraisal system? To help you figure out an answer, here's a list of features of a top-quality appraisal system that you can use for comparison purposes:

- Performance appraisals are current.
- Data entered as part of the record is reasonably objective.
- Appraisal forms are easy to use and to understand.
- Employees are fully informed on the purpose of appraisals and their methods, plus the uses of the information developed from appraisals in follow-up personnel actions, such as promoting, demoting, training and retraining.
- Performance standards are comprehensive, clear, measurable (including subjective factors) and communicated to employees.
- There is an established procedure to handle employee complaints regarding the appraisal system.
- Employees are given both written and oral statements regarding the results of the appraisals and are asked to indicate by signature the receipt of the results; the employee also has the opportunity to enter differing views into the appraisal file.
- The appraisal system allows additional opportunities for management and employees to communicate about job performance, other than a single annual review.
- The appraisal is conducted in terms of specific needs of the employee, the job and the business, and not in abstract terms such as "value to the organization" or "long-term promotability." Techniques used in the appraisal process are relevant to the purposes of the appraisal.

If you determined that your system is not up to snuff, but you aren't worried about it, maybe I can get your attention by noting that appraisals have broader applications than merely documenting employee performance. Performance appraisals, if properly done, can also serve to:

- Help employees identify their full potential within the organization, thereby tending to maximize the utilization of personnel (and cut deeply into turnover statistics).
- Provide integrated job and personnel information to improve the quality of distribution of work and job assignment.
- Validate job placement and career plans.
- Identify personnel problems early on.
- Improve the working relationships between management and employees.
- Select candidates for future management slots.

If you still feel that appraisals are just a paper work nightmare, then perhaps your own performance should be judged, in part, on how well you support and conduct personnel appraisals. If this policy is implemented, I'm confident that the yelps and hollering that are often heard at "appraisal time" will diminish into the noise level.



Users Must Share Blame for 'Horror Stories'

(Continued from Page 81)

and not "how good." In the field of consulting, I find it literally astounding that I can talk myself blue in the face, armed with facts, figures, third-party stories, newspaper clippings and so forth only to hear that the customer has decided to go a cheaper route or the "do-it-yourself" route! I find him a short time later proclaiming "misrepresentation, whiplash, food poisoning" or whatever.

It wasn't too long ago that a "bargain hunter," having fallen ill, could seek out a medicine show and purchase remedies and cures from a peddler rather than going to a reputable, highly trained and more costly medical practitioner.

It was only after a significant number of citizens got burned that the federal government removed one of our freedoms and began putting some of those "quacks" in jail. Yet today, enterprising marketing companies come dangerously close to offering so-called cures and remedies through various advertising media. And judging from the size of their advertisements, they must be doing a land-office business. Why must we always be protected against our own search for bargains?

Big Mistake

A great number of businesspeople are making the mistake of buying books that promise to make them "informed computer purchasers" in one night of easy reading. That's as useful as reading a medical journal before going in for an operation. If you're buying a computer for your business, you don't need to be in DP. There are people trained for these jobs. Colleges are offering degrees in computer-related fields. There is nothing simple about a totally interactive order processing and general accounting system. You don't have to learn all about computers to get one to work for you any more than you have to study internal-combustion engines to drive to work.

A computer system should be installed at your office preprogrammed and ready to perform the specific jobs you had in mind at the time you purchased it. The books may be interesting, but they can't make you an expert. Businesspeople who find themselves getting involved in the detailed algorithms of computer programs often find themselves neglecting their own businesses.

A very successful businessman once told me, after he had purchased a Texas Instruments, Inc. computer, that his son (who had no previous programming experience) was going to take a three-day course and return to write all the necessary programs he needed to run his real estate company. Another businessman recently told me that he had a CPA friend who, given a couple of days, could write a computer program to make a computer do anything he wanted it to do.

These things are simply not possible. There is no cheap way of getting a computer system to perform more than simple tasks. A business computer installation will become a major investment. It should be planned for, thought about and planned for again.

It takes years to become a proficient computer programmer, yet businesspeople all over the country are entrusting their systems to would-be programmers with nothing more than a few hours of self-taught "game" programming behind them. This is really absurd. At the present time good computer programs may cost $100 or more per line of error-free code to develop. This means that a small company might spend from $40,000 to $80,000 to develop a totally integrated financial accounting system.

If you are considering a computer installation, you have become a prime target for a fast-talking, low-balling computer salesman. You'll need facts, proof, demonstrations at businesses already using a comparable system and, most of all, *expert* assistance.

Here are a few basic rules to prevent a costly mistake. You must adhere to them rigidly:

- Put everyting down on paper!
  - a. What do you want the computer to do? Exactly!
  - b. How much can you afford to spend?
  - c. When do you want it installed and working?
- Go find an expert! And I don't mean a relative who sells calculators or has taken a programming course in college. Hire a reputable computer consulting firm to go over your notes, and pay it to do an in-depth study of exactly what type of software is required to make a system work for you.
- Buy the computer system on which the software was designed to operate! The greatest software package in the world could be worthless to you unless you have the computer system for which it was designed. Ask the expert to determine that the system is expandable to meet your future requirements.

Further, I'm sure that there are hundreds of professional businesspeople who have purchased inadequate software, hardware or both and have invested so much money in their present system that they feel compelled to continue to throw good money after bad in an attempt to salvage something from a very embarrassing mistake. Well, pride is not the better part of survival. If you are one of these people, stop and go find an expert.

Scott is director of marketing for Applied Information Management Sciences, Inc. in Monroe, La.

What About the DP Manager? — Part 2

Data Dictionaries Bring DBMS Control

By Ron Rose
Special to CW

Despite current shortcomings, data dictionary packages are perhaps the most significant tool evolved to date to help the DP manager bring control over system development. The only drawback — and it proves to be a major one — is that almost all data dictionaries fail to support the preimplementation phases of the data base system project. If the data dictionary concept could be reoriented to address these phases, a powerful tool for controlling data base development projects would be offered to the DP manager.

What, When, How

Some reflection on the data dictionary approach shows why this is true. First, a data dictionary describes what information is to be collected, when to collect it and how to use it. The data dictionary provides coordination and stability to the efforts it supports because it gives permanence to the information and specifications on which those efforts are based.

The DP manager vs. DBMS confrontation can be a painful one. Part 1 of this two-part series explored some of the control and coordination problems a manager faces when installing a DBMS [CW, Dec. 22]; Part 2 describes some of the possible solutions.

It also helps the manager to marshal scarce staff resources by providing guidelines and conventions for the types of information to be collected. Thus, even inexperienced staff members can be productive in associated tasks.

The data dictionary promotes the establishment of orderly procedures by providing a focal point for review and development. Since each stage of the project can be assessed for completeness by reviewing associated dictionary documentation, clear-cut progress milestones can be established.

If applied to preimplementation phases of the data base system project, better control over the complex and crucial tasks of planning, estimating and scoping could be the result.

Another data dictionary advantage is that it functions as a central repository of information that can be shared by everyone, including end-users. This promotes communication and coordination.

Finally, the data dictionary is a crucial tool for both the data base administrator (DBA) and the data administrator (DA) because it puts real teeth into their control over system definitions. If this is effective during implementation and post-implementation phases of the project life cycle, dictionary participation in the preimplementation phase — the make-or-break period for adherence to standards — could significantly improve this control.

Today's data dictionary packages are not truly design dic-

(Continued on Page 90)

Tektronix Adds to 'Plot 50' Line

BEAVERTON, Ore. — Tektronix, Inc. here added seven products to its Plot 50 library for its 4050 series desktop computer. The software library includes graphing, drawing, document preparation, statistics, planning, management and digitizing programs that range in cost from $600 to $4,000.

The picture composition software was designed to aid the non-computer user in the development of engineering working drawings, Tektronix said. It reportedly allows the user to interact with graphics elements so that objects can be displayed, moved anywhere on the screen and deleted without affecting other display components.

Essentially an electronic sketch pad, it allows "virtually unlimited" drawing complexity because the user builds drawings from "graphics primitives" that include lines, arcs, boxes and circles, the vendor claimed.

Supporting the Model 4050 with dynamic graphics option, this package is priced at $1,500.

The new document preparation program was designed to assist in formatting and generating technical reports in an engineering or scientific environment, according to a spokesman.

An interactive text formatting program, it offers some 45 editing commands and operations that allow for producing two-sid-

(Continued on Page 90)

CICS, 'Shadow II' Users Get CPG

ATLANTA — Insac Software, Inc. is offering CPG, a programming language and execution environment for users of IBM's CICS/VS and Insac's Shadow II teleprocessing monitor operating under IBM's DOS/VSE, VS1, SVS and MVS operating systems.

Designed for on-line programming, CPG generates multi-threaded programs for the teleprocessing environment, according to the vendor.

CPG is an open-ended nonprocedural language with integral screen mapping and data editing facilities.

It provides on-line interactive debugging and enables any program to be tested alongside production systems without the possibility of corrupting those production systems, the vendor claimed.

CPG costs $19,500 from Insac at Suite 3235, 2300 Peachford Road, Atlanta, Ga. 30338.

'Dataquery' Gets 4300 Support

PRINCETON, N.J. — Applied Data Research, Inc. (ADR) has announced Release 2.1 of Dataquery, the data base query package for its Datacom/DB relational-like data base.

Highlights of the release include support for IBM's 4300 hardware and fixed-block architecture on 3310 and 3370 disk drives; enhanced security; additional arithmetic capabilities; enhanced output facilities and formats such as support for user-specified headings in place of standard file names and access to numerical data for display and edit, the vendor said.

Release 2.1 is a free enhancement for users of Dataquery. The package costs $1,100 for users in an OS environment and $9,300 in a DOS environment. ADR is at Rt. 206 and Orchard Road CN-8, Princeton, N.J. 08540.

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Data Dictionaries Ease DBMS Development

(Continued from Page 89)

tionaries. Therefore, they provide little real assistance in the areas of project organization and control.

An assessment of currently effective data base system design methodologies — methods already in use in many state-of-the-art shops — shows that support for data models of the following areas would be required in a design dictionary:

• Organization of the company, its functions and the data used to perform these functions. This information, needed for data usage commonality carves out functions and data resource areas for phased development under the data base.

• Detailed end-user system requirements for the selected functions or data resource areas. Definition of these requirements should capture both the local data view — the structure of the data the user sees — and the delivery characteristics of that view. These include its frequency, volume, currency, availability and security, sequencing and qualification requirements.

These detailed requirements must be specified in such a way that users can discuss and understand them. While capturing data base potentials, they should avoid data base management system (DBMS) bias.

These detailed requirements must be integrated with the rest of the design dictionary to provide vital continuity for developmental success.

• Comprehensive blueprint for the planned data base system — logical data base architecture. Developing a logical architecture allows the design dictionary user to express the grouping of data elements into record types, record types into logical files and required keys and sequences in DBMS-free fashion. The data resource is defined optimally to ensure its evolutionary capacity and ability to satisfy end-user requirements.

The Changing Picture

Recent attention has been focused on tactical tools devoted to specialized tasks in the data base architecture area. Relational data analyzers are one example.

Real assistance for the DP manager will arrive only when such tools are integrated within a master data base design dictionary system.

While some data base system design methodologies recommend the design dictionary concept, this dictionary is usually generated manually. Attempts to mesh it with the corporation's standard data dictionary usually meet with marginal success and the control aspect is not emphasized.

However, the picture is changing rapidly for several reasons. First, as data base system experience increases, the lack of a developmental control tool is becoming more apparent.

Second, data dictionary vendors are coming to a realization that a radical new approach is needed.

Finally, the advocates of various data base design methodologies are learning that implementation of a formalized discipline of collecting and maintaining specifications is necessary for the effective operation of the methodologies.

Ross is the editor of Performance Development Corp.'s Data Base Newsletter. *He has recently written a book on data administration and data dictionary systems that is scheduled for release by Amacom, the publishing arm of the American Management Association.*

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Tektronix Adds To 'Plot 50'

(Continued from Page 89)

ed documents, an automatic table of contents, automatic page numbering and text insertion, he said.

Available for the 4052 and 4054 computers, this package costs $800.

Presentation Aids

A presentation aids package that creates bar charts, line graphs, pie charts and text on overhead transparencies was introduced for $850. The software produces quality text with a software font, widths and thicknesses so that charts and graphs can be combined with text on a single overhead slide, the vendor said.

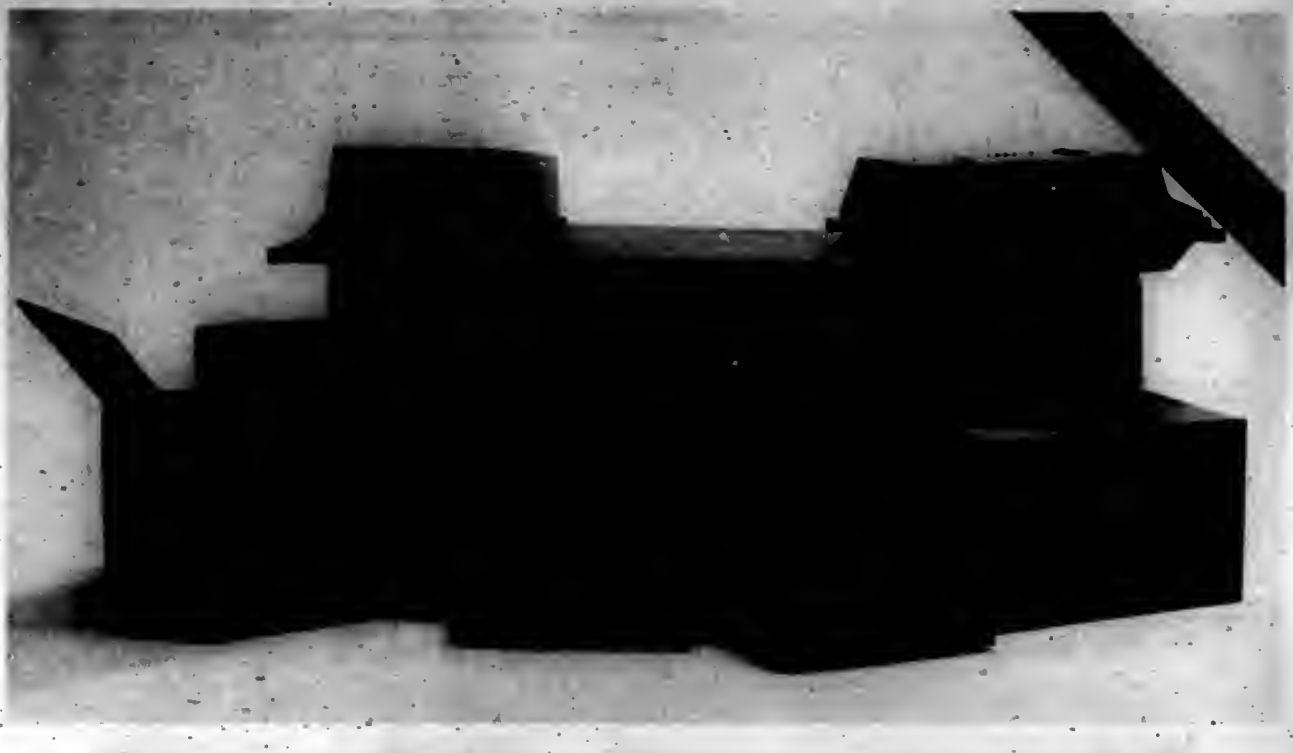
An interactive modeling package utilizes the 4050 graphics capabilities to create graphs, charts and diagrams that depict various project models, according to a company representative.

Designed to effectively schedule and track projects and to evaluate the interdependencies of tasks within a project, the project management software costs $4,000.

Two statistics software packages introduced at the same time offer analysis of variance and statistics and multiple linear regression at $800 each, the spokesman said. The second and third products in the Plot 50 statistics software family, they are disk-based programs that utilize a standard file format to allow different programs in the series to share data, he added.

The last product in the announcement was an interactive digitizing package designed to simplify graphics data base creation.

A menu-driven program that supports the 4052 and 4054 computers, it utilizes the 4956 graphics tablet for input and the Model 4907 file manager as a flexible disk storage device, according to Tektronix, which can be contacted through P.O. Box 500, Beaverton, Ore. 97007.



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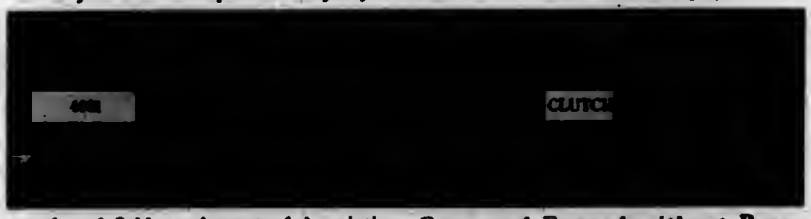

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Cobol Source Code Generator

'C/Script' Out for DG's AOS

AUBURN, Ala. — A Cobol source code generator formerly available only on Data General Corp.'s Icos operating system is now available for its Advanced Operating System AOS from Commercial Systems Corp.

The System Development System, C/Script, is said to reduce program development time by as much as 95% and program debugging time by as much as 100%.

C/Script takes user responses to questions and generates Cobol source programs to handle the functions of data entry, file maintenance, reports and inquiries, according to the vendor.

OEM and end-user licenses cost $7,500 and $4,500, respectively. Commercial Systems Corp. will reimburse travel expenses of up to $1,000 for prospects reviewing C/Script if they subsequently purchase a license. The firm can be reached through P.O. Box 2338, Auburn, Ala. 36830.

HP Software Available For 9800s

PALO ALTO, Calif. — Hewlett Packard Co. is offering Linear Systems Analysis software for its Series 9800 System 35 and System 45 desktop computers.

The software includes modules for entering the system design into the computer, producing analysis plots of the system performance.

It will be useful to electrical, mechanical and chemical control engineers, the vendor claimed.

The product is available for a one-time license fee of $500, the vendor said from 1501 Page Mill Road, Palo Alto, Calif. 94304.

Interface Links 'Datamanager,' 'The Librarian'

LEXINGTON, Mass. — Users of MSP, Inc.'s Datamanager data dictionary can obtain through Datamanager's Swap-Shop an interface program to The Librarian, Applied Data Research, Inc.'s program library management system.

Written by Magazine Zum Globus, Switzerland's third largest department store, the interface program was designed to synchronize the contents of the source program library and the data dictionary without the need for clerical updating.

Currently available for users of IBM's OS operating system, the interface program carries a handling charge of $25 through the Swap-Shop. MSP is located at 21 Worthen Road, Lexington, Mass. 02173.

'Estimator' Aids User Projections

PHILADELPHIA — Atlantic Software, Inc. has announced the automation of the estimating standards and process of its SDM/70 Systems Development Methodology.

Estimator, which can be provided with SDM/70 or as a stand-alone system, is said to help users estimate project time and cost for each phase of the systems life cycle.

Base price for the Estimator is $15,000 from 320 Walnut St., Philadelphia, Pa. 19106.

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For Series 1100

Univac Combines Screen Generator, Handler

BLUE BELL, Pa. — A Display Processing System (DPS) for the Sperry Univac Series 1100 mainframes assists users in the development and execution of application programs by combining an interactive screen generator and a screen handler.

The DPS 1100 will increase programmer productivity by eliminating the programming overhead typically associated with applications that create and access computer terminal displays, Univac claimed.

All input and output screen format design is done at the terminal by users entering the actual formats and field attributes to be used in an application.

Tutorial Mode

The screen generator has a tutorial mode which prompts and explains how to create or revise screens using the DPS 1100. Once screens are formatted, they are stored in a central screen file.

The screen handler portion of the DPS 1100 allows for the interaction of a program with these stored screens, the firm said.

The unit functions in either a transaction system such as the Series 1100 Transaction Interface Package (TIP) or in an interactive program development mode using the Conversational Timesharing System (CTS).

In addition to the screen generation and screen handler, other features of DPS provide for data editing and validation, applying passwords to screen and separate fields of screens and creation and controlled access to multipage screens.

Terminals supported by DPS 1100 are the Uniscope 100 and 200, the Universal Terminal System UTS 400 and the UTS 20 and UTS 40 of the UTS 4000 family.

The charge for DPS 1100 is $250/month and is available from Sperry's marketing branches throughout the U.S. The vendor can be reached at P.O. Box 500, Blue Bell, Pa. 19424.

Newsletter Offers Tips On Testing

SAN FRANCISCO — Software Research Associates here is offering free subscriptions to its quarterly newsletter, "Testing Techniques."

The newsletter, devoted to the technology of software quality assurance, addresses methods that serve to enhance the effectiveness and quality of computer software of all kinds, a spokesman said.

Recent articles in the newsletter have included descriptions of quality analysis of Cobol programs, a description of structural coverage measures for single modules, investigations of methods for hierarchical decomposition of programs and methods for instrumentation of structured programs.

"Testing Techniques" is available free of charge to anyone who requests a subscription on company letterhead.

'Datascan' Gets WP, Graphics

WHITE PLAINS, N.Y. — Vista Computer, Inc. has unveiled graphics and word processing (WP) options for its data base management and reporting system, Datascan.

The graphics option allows users to depict with point, bar or connected-line graphs information that was previously presented only in report form, the vendor claimed.

The WP option combines the capabilities of a typewriter with enhancements that include editing functions associated with word processors, including 132-char. output.

The options cost $5,000 each.

Vista Computer is located at 709 Westchester Ave., White Plains, N.Y. 10604.

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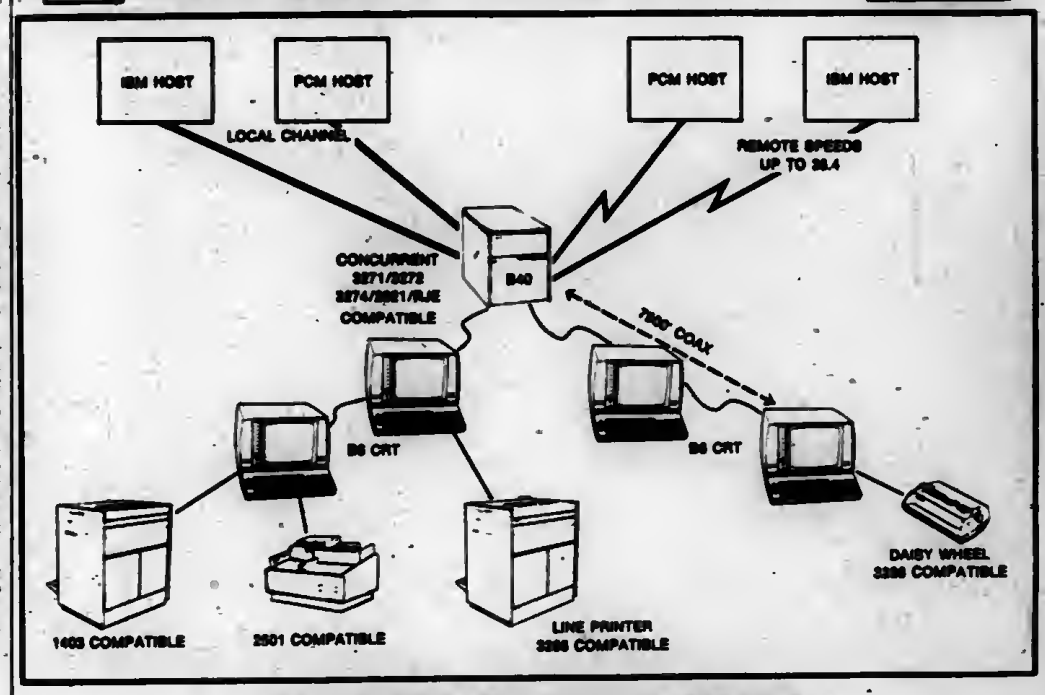

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'Super/Doc' Aids Users In Cobol Documentation

VAN NUYS, Calif. — A Cobol program documentation system designed to provide management, programmers and analysts with standardized tools for program and system documentation is available from Occidental Computer Systems, Inc. It runs on IBM and other Cobol systems.

Super/Doc is a complete set of program documentation outputs that may be selectively generated from a Cobol source program. It allows the user to utilize any or all of the 10 possible outputs for program documentation or as programmer aids in maintenance and debugging activities, the vendor claimed.

The system costs $1,260 from Occidental at 6666 Valjean Ave., Van Nuys, Calif. 91406.

'JSS' Release for IBM 5280 Includes Utility Package

JEFFERSON CITY, Mo. — Software Systems, Inc. has announced Release 2 of its Job Stream Supervisor (JSS) for the IBM 5280 distributed data system. This release includes a utility package consisting of FILE BUILD, DELETE, COPY and RENAME.

The JSS is an operating system that gives the 5280 the ability to execute job streams and procedures from menus using a System/34-like job control language, "effectively turning the 5280 into IBM's lowest priced small business computer system," Software Systems claimed.

JSS Version 2 is available immediately for a license fee of $500.

Software Systems can be reached through Box 1766, Jefferson City, Mo. 65102.

Series/1 WP Package Bows

SAN JOSE, Calif. — Systar Corp. has announced a new version of WP/1, the firm's word processing (WP) package for the IBM Series/1.

The new version is said to give users increased capability to create documents using stored information. "Boiler plate" letters from a mailing list or customized contracts from a series of stored paragraphs reportedly can be created.

WP/1 operates under EDX and can be run simultaneously by multiple users or in conjunction with other EDX-based application programs. WP/1 is provided on diskette with a self-teaching user's guide. A one-time license fee costs $2,500 from the firm at Suite 208, 1762 Technology Drive, San Jose, Calif. 95110.

Bentley College Continuing Ed To Offer Three-Day DBMS Meet

WALTHAM, Mass. — Bentley College Center for Continuing Education will offer a three-day seminar on data base management systems (DBMS) here Jan. 12-14.

Fundamentals of the data base concept, organizing information for storage and retrieval, the data base design process, new data base environments and organizing the data base administration function will be discussed. Participants will also learn the selection of the right data base system at the right price and with adequate back-up services and support from vendors.

Harvey M. Weiss will conduct the seminar. Registration costs $560 for the seminar.

More information is available from Bentley College's Center for Continuing Education, Beaver and Forest Sts., Waltham, Mass. 02254.

Rosa Elected Mims President

TUSTIN, Calif. — Joseph J. Rosa, director of management information services at Management Assistance, Inc.'s Basic Four Information Systems Division, has been named president of a newly formed group of users of Mitrol Industrial Management System (Mims) software.

Mims, a data base management system and high-level language, is used by many large companies for management information processing and reporting.

It was first developed by the Mitrol Corp. in Burlington, Mass., and is now owned by the General Electric Information Services Co.

The next group meeting will be held in the Netherlands in June.

Further details are available from Joseph Rosa at MAI's Basic Four Divisions, 14101 Myford Road, Tustin, Calif. 92680.

Audit Tool Directory Offered

CHICAGO RIDGE, Ill. — A directory that enables readers to identify and locate audit software tools that are available to perform specific audit tasks is available from EDP Audit Associates, Inc.

"Audit Utility Tools Directory" explains what 24 tools do, the systems within which they operate, their languages, advantages, suggested uses, minimum hardware, required training and cost.

The preliminary volume costs $25, including all first-year updates. Subsequent periodical updates will carry a nominal fee. The firm can be reached through P.O. Box 255, Chicago Ridge, Ill. 60415.

System/34 Gets Documentation

NEWTON UPPER FALLS, Mass. — A software documentation package for the IBM System/34 that is said to automatically provide management-level documentation without adding to a programmer's work load is being offered by Mann Data, Inc.

The package, made up of 12 reports, generates documentation that meets commercial standards and includes features not found on any other System/34 documentation packages, the firm claimed. By inserting the package in the job stream after program modifications have been made, users automatically receive a complete set of updated documentation.

The key reports offered by the package not found elsewhere, according to the firm, include an automatically generated table of contents; the ability to automatically describe procedures, files and programs with descriptive narrative; a screen/program cross reference; the ability to "explode" procedures so programmers can see the files that the procedures use; a procedure/-program cross-reference that lets programmers determine a list of procedures that are affected if a program is renamed or revised and a report layout that gives the title of a report and duplicates its format so nonprogrammers can identify it.

The System 34/documentation package costs $1,200 from Mann Data, Inc. at 50 Tower Road, Newton Upper Falls, Mass. 02164.

Table Changer For CICS Use

OVERLAND PARK, Kan. — HLE Systems, Inc. has unveiled a CICS On-Line Table Changer which reportedly allows changes in a real-time mode to the Program Control Table (PCT) and the Processing Program Table (PPT)

The utility runs under DOS and OS in less than 20K bytes of memory and eliminates the shutting down and restarting of CICS for a table change to either the PCT or PPT, the vendor claimed.

In addition, up to 10 different table options can be made.

The product costs $500 for source code and documentation, the vendor said from P.O. Box 4714, Overland Park, Kan. 66204.

Employment Job Browse Facility Designed for 8100s Under DPCX

WHITE PLAINS, N.Y. — IBM has announced an Employment Service Job Browse Facility for 8100 systems running the DPCX operating system.

The package was designed for state bureaus of employment security to offer an automated self-help job information system, using IBM 3270 terminals equipped with light pens.

The package is menu driven and lists available jobs by category and geographic location, according to IBM.

Most employment security offices currently use a microfiche system to list jobs. The 8100 package could be more easily updated, IBM said.

The package can be installed on the 8100 at a remote site, or it can be generated from a 370-compatible host, according to IBM.

The package costs $90/mo on a one-year basis, IBM said.

Software Bows For Dentists, Consultants

MISSION VIEJO, Calif. — Compusoco has announced software packages for dentists, attorneys and consultants. The packages were designed to perform appointment scheduling, professional time management, private client billing and management reporting.

The dental package, Professional I, features preparation of American Dental Association claims forms for third-party patients and facilitates the location and preparation of notices to patients who are due for them.

Professional II was geared for attorneys and features preparation of special reports for third-party legal plans and special accounting plans to analyze court-time usage and work on retainer or contingency engagements.

Professional III was designed for consultants, accountants and contract administrators. It allows the creation of subjobs, special cost centers, overhead accounts, billing under time and materials contracts, fixed-priced job cost accounting and other functions, the vendor claimed.

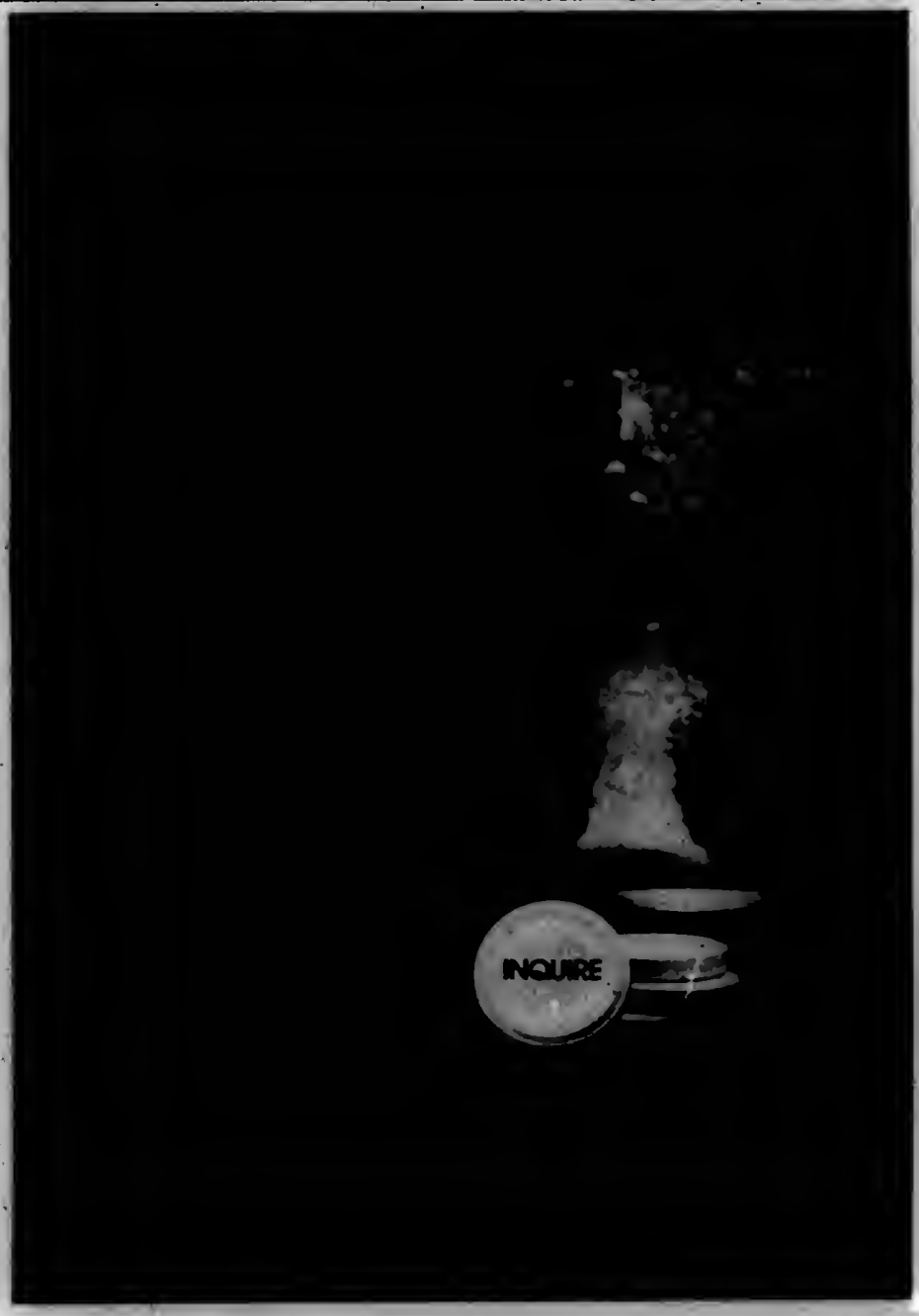
Each package costs $750, the vendor said from 26251 Via Roble, P.O. Box 2325, Mission Viejo, Calif. 92690.

Candle Monitor, Analyzer Back CICS

MARINA DEL REY, Calif — Candle Corp. has announced that its Omegamon/CICS real-time monitor and RTA/CICS response time analyzer now support Version 1, Release 5 of CICS in addition to CICS 1.3, 1.4 and 1.4.1.

Omegamon/CICS costs $15,000, and the optional RTA/CICS costs $5,000.

Candle is at Suite 624, 4676 Admiralty Way, Marina del Rey, Calif. 90291.



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DATA SYSTEMS for INDUSTRY

At one of 20 sites around Genrad's Acoustics, Vibration and Analysis Division, Tom Freeland pauses to speak with one user of the division's manufacturing information system.

Manufacturing Software Smooths Genrad Inventory

SANTA CLARA, Calif. — Beset by inventory control problems, Genrad, Inc. installed an interactive, on-line manufacturing software system to expedite the firm's business transactions.

Extended lead times, constantly changing prices and the burden of coordinating remoter assembly locations were some of the major problems leading to the purchase of NCA Corp.'s MS-11 package for Genrad's AVA Division.

Genrad was shipping less than $500,000 of orders a month using a manual inventory system when Tom Freeland, manufacturing manager at Genrad, first came to the company three years ago.

Using Genrad's new Digital Equipment Corporation PDP-11/35, Freeland supervised the six-month implementation of the $60,000 package. It went into receiving, storeroom, purchasing, receivables, accounts payable, data control and the MIS groups, as well as marketing and finance. Twenty terminals are placed at strategic sites throughout the plant of approximately 100 employees.

"With both the MS-11 system and well-defined product documentation, I knew we had the necessary building blocks to turn the operation around," Freeland said. "If marketing could provide the sales backlog necessary, I felt the shipping target could be achieved."

Today, AVA is shipping over a million dollars worth of product per month, and growing rapidly.

Saving hours of running around to various locations and departments for information, Genrad planners, buyers and schedulers use MS-11 as a common communications system, linked in real-time, right from their own desks.

"It's not like a batch system where all you have is last week's information," Freeland explained. "We immediately know where and how much we have at all of our locations. Thus, inventories remain at a minimum at all times."

Following a management-by-exception policy, Freeland can be confident he is in control. If either quantity or cost of input exceeds the bounds that management has established, the comprehensive nature of MS-11 directs attention to the difference. Freeland and his staff can then focus their efforts where they will do the most good.

Inventory Cuts

Stressing that aggregate inventory totals represent only the tip of the iceberg, Freeland believes the real value of Genrad's integrated MS-11 system is in its ability to take cuts across inventories. He illustrates his point by discussing the total inventory and accepted industry ratios.

"Our total inventory — including receiving, stockroom, work-in-process and finished goods — follows the industry rule of not letting inventory exceed 20% of sales.

"We're running right on target. Because we can take this cut across the inventory by product line, we can immediately defer delivery or payment in accordance with the schedule maintained on the MS-11.

Having advance knowledge of those suppliers who have slipped their delivery promises is paramount in running an efficient factory. At any time, Freeland can instantly ascertain Genrad's total commitment to vendors, who they are, when their products are due and other vital performance measurements.

The MS-11 provides a simple and effective approach to monitoring vendor performance.

Suppliers who are consistently early in their deliveries may create a serious impact on inventory carrying cost, storage, cash flow, warehousing and traffic. In such cases Genrad can immediately defer delivery or payment in accordance with the schedule maintained on the MS-11.

International Software Meet Set for San Diego in March

SAN DIEGO — The Fifth International Conference on Software Engineering to be held here March 9-12 will feature demonstrations by commercial, academic and government software tool builders.

The goal of the conference is to increase knowledge of what software tools can do and how they can be used productively in software engineering.

The conference will include tutorial and seminar sessions. The charge for each tutorial ranges from $65 to $100, depending on when attendants register and whether or not they are members of the Association for Computing Machinery (ACM) or the Institute of Electrical and Electronic Engineers (IEEE).

More information is available from Ray Houghton, National Bureau of Standards, Room A266, Technology Building, Washington, D.C. 20234.

Theta's 'PDS' Offered Users Of DEC RT-11

GLENDALE, Calif. — Theta Business Systems is offering a Pascal Development System (PDS) for users running under Digital Equipment Corp.'s RT-11 operating system.

PDS can run in single-job or multiuser modes under TSX. It also runs within the standard 56K-byte RT-11 operating system, the vendor said.

Theta includes PDS with its accounting packages; however, it lists for $1,000, the vendor said from Suite 106, 1110 Sonora Ave., Glendale, Calif. 91201.

HP Desktops OK for McAuto

ST. LOUIS, Mo. — Three models of Hewlett-Packard Co.'s 9845 desktop computer have been qualified as remote terminals for the time-sharing network of McDonnell Douglas Automation Co. (McAuto).

The qualified models are Systems 45B, 45S and 45T. Systems 45B and 45T communicate with a host computer at line speeds up to 1,200 bit/sec. System 45S communicates at speeds up to 300 bit/sec.

HP's terminal emulator software for the 9845 computer must be modified slightly to communicate with McAuto's time-sharing network, but McAuto supplies instructions for making these changes.

McDonnell Douglas is headquartered in St. Louis, Mo. 63166.

'Denta-Count' Rx For Dental Clinics

SPRINGFIELD, Mo. — An integrated financial management package for single-doctor offices or multiple-dentist clinics is available from Data Center, Inc. It is named Denta-Count.

Designed for use with the AM Jacquard Systems, Inc. line of minicomputers, the package includes accounts receivable with systematic aging, billing, patient records control, relative value system, insurance claim handling and predetermination setup.

The basic system costs $19,000, the vendor said from 1950 V S. Glenstone, Springfield, Mo. 65804.

APL Video Course Out

TORONTO — A training course on APL is available on video tapes from Numetrix Limited.

The 20-hour course includes student manual with workbook and five video tapes. The course assumes no prior knowledge of computers or APL.

The course carries a one-time license fee of $5,000 from the firm at Suite 600, 3 Church St., Toronto, Ont., Canada M5E 1M2.

Accounts System Runs on PDP-11

ST. PAUL, Minn. — An accounts receivable and sales analysis system that runs on Digital Equipment Corp. PDP-11 computers under RT-11 and RSX-11 is available from PBS Computing.

The systems were designed for large and small businesses and offer several options for determining the format of monthly statements.

Statements show detail on activity for the month and can be produced with several optional user-defined promotional or dunning messages.

The accounts receivable system costs $2,500 alone and $3,000 with the sales analysis module, the vendor said from 3550 N. Lexington Ave., St. Paul, Minn. 55112.

DEC Users Get 'EZsort'

LOS ALAMITOS, Calif. — Software Techniques, Inc. has announced a program-internal sort capability for users of Digital Equipment Corp. operating systems.

Version 4.0 of EZsort runs on both RSTS/E and RSX, providing Basic-Plus-2, Cobol and Dibol applications programmers with reportedly fast "in-program" sort capability.

EZsort is said to work with any file management software, including Databoss, DBMS, DMS500, FMS, RMS and Total.

EZsort costs $775, with OEM discounts available from the firm at Suite 101, 5242 Katella Ave., Los Alamitos, Calif. 90720.

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On Chemical, Toxic Substances

Shell Oil's DBMS Keeps Information Flowing

By Phil Pack
Special to CW

HOUSTON — Up until four years ago, information about a chemical substance at Shell Oil Co. was handled by various departments or laboratories responsible for testing developmental substances. If a person was looking for information on a chemical outside his own area, he usually faced a lengthy search for the data.

At the same time, public concern over the toxic effects of chemical substances and their environmental impact was growing, and the Federal Environmental Protection Agency (EPA) issued its Toxic Substances Control Act (TSCA) requiring more recordkeeping and reporting on substances.

During this period — 1976 — Shell formed the Health, Safety and Environment (HS&E) organization, which assumed a number of responsibilities including supplying certain information on products and chemicals. HS&E's Information Services Department (25 people) was designated the primary supplier of product information providing standard reports, ad hoc retrievals and helping government reporting requirements — a big job.

When we assessed the business environment, we could forecast significant increases in the internal and external demands for product information in the future. We could see the need for a central repository of product data for supplying information on the physical and chemical properties of materials, toxicology information, health studies and other data as required for regulatory compliance. We knew our current manual methods of recordkeeping and reporting were just not cost-effective.

Establishing Objectives

Several objectives for a new Product Profile Information System were established: the system must be cost-effective, usable by non-data processing people, modular to facilitate growth and integration, have an expected life of 10 years, be secure and use existing software and hardware, when feasible, to take advantage of the experience base.

We looked at the objectives for the system and measured them against available software packages, including those that could be developed. When we began looking for keyword text processing capabilities, we checked to determine if any of the several proprietary software packages already in-house could do the work, including the Inquire data base management system (DBMS) from Infodata Systems, Inc.

When we considered the user-friendliness factor, Inquire was our best candidate. Inquire had been in use at Shell since 1970 for other systems, including several HS&E applications.

The core data module for the Product Profile Information System is a non-bibliographic data base that permits the recording of information contained in Shell's Material Safety Data Sheets. The system also handles the printing and distribution of these sheets to customers and employees for use in handling the materials.

Inquire handles all the data as well as mailing information, but more important than routine mailings, the system will automatically print revisions for all persons who received the original safety sheets. To help speed data collection, an IBM OS/6 word processing system is used and a Cobol program is used to interface between the word processing system and the DBMS.

Future plans include adding to the Product Profile Information System other modules containing information on Shell's products, including the Toxin and Chemfile data bases, which allow multi-data base retrieval. The modular design of the systems will permit adding additional information modules, additions anticipated to continue over the next five or six years.

Development Background

The Toxin and Chemfile data bases are two of many specialized information retrieval systems developed in 1977 under HS&E. Both took six months to develop and become operational. Mary Cubillas, senior information technologist in HS&E's Information Services Department, has been largely responsible for the development of these two applications.

"When the new HS&E organization was formed in 1976, we were faced with boxes of reports to index and catalog," she explained. "These reports included internal Shell toxicology reports, reports from contract laboratories outside of Shell as well as reports from such organizations as the American Petroleum Institute.

"Though the reports are circulated among corporate toxicologists first, our department has the responsibility for their retention and retrieval. We had been using Inquire for several years for handling toxicological data and were glad to have its help with the mammoth task ahead of us.

"Step one for our group was to determine what elements of these reports should be indexed to meet the needs of the HS&E professionals. We developed a prototype system and presented it to the toxicologists for comment. What evolved was a system containing, in addition to bibliographic information, four types of classifications: chemical substance indexing, study classifications, subject keywords and an abstract which included toxicology data extracted from each report, Cubillas said.

"Indexing of the chemical substance is extremely important in the Shell Oil Toxin application. Many times, reports are retrieved from this system for submission to governmental agencies or for the evaluation of the toxicity of a chemical by the Toxicology Department. Retrieval must be precise, even though reports may refer to the chemicals by trade names, product codes or by varying chemical nomenclature.

The demand for product information continues to increase rapidly and, as additional regulations are promulgated by federal and state agencies, the need for effective information systems to record and report this information will be more severe. We believe our Inquire-based Product Profile Information System will handle the increased volumes and let us satisfy these information needs cost-effectively.

Pack is manager of HS&E's Information Systems Department.

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Re Conversion Functions

FCC Asks Comments on Inquiry II Rule

By Phil Hirsch
CW Washington Bureau

WASHINGTON, D.C. — The Federal Communications Commission (FCC) has asked interested parties to comment on whether some protocol/code conversion functions should be included in the "basic" services defined in its recent Second Computer Inquiry Decision [CW, Dec.22]. The question is esoteric, but nevertheless crucial to users, AT&T and other vendors.

If these conversion functions are made a part of basic services, AT&T operating companies will be able to interconnect a much greater variety of otherwise-incompatible user terminals, application programs and private networks. The specialized carriers — such as Telenet Communications Corp. and Tymnet, Inc. — already provide such interconnection, will face increased competiton. Firms marketing specialized services, such as electronic mail and on-line information to the home, would also be impacted, since they typically use the telephone network and would have to interface with AT&T's protocol.

If the phone company's plans for entering these specialized markets materialize, Bell would be able, at least theoretically, to curb competiton by changing its protocol. Since it would take the other vendors awhile to change their software, once the new specifications were announced, AT&T could gain a marketing advantage, at least for awhile.

'Enhanced' Function

The FCC's "final" computer inquiry decision, issued last April, said protocol/code conversion was an "enhanced" rather than a basic communications function, meaning AT&T could provide it only through a separate subsidiary and not through a telephone operating company. However, the commission also said it planned an inquiry to consider whether some protocol conversion functions ought to be included in basic services. A notice describing that inquiry was

(Continued on Page 100)

Emulex Enters Front-End Mart With DEC-Compatible Mux

SANTA ANA, Calif. — Emulex Corp. has entered the communications front-end market by introducing a multiplexer subsystem that provides users of Digital Equipment Corp's. DH11 multiplexer with improved line-handling capabilities in a smaller package and at less cost, according to the firm.

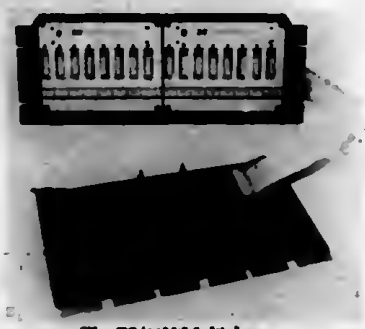
The CS11/H communications multiplexer gives users of any PDP-11 or VAX-11 computer the ability to connect up to 64 asynchronous communications line devices to a single controller board housed within the CPU backplane. Additional lines may be connected by adding a communications controller card to the CPU and line adapter cards to external distribution panels, the firm said.

The multiplexer uses a single hex size circuit board for the CC11/H communications controller that is connected by a 34-conductor ribbon cable to as many as four CP11 distribution panels, each of which contains its own integral power supply and either one or two eight channel Call Line Adapters.

The line adapters provide the data and modem interface circuitry plus the Uart-type circuitry which provides the serial-to-parallel and parallel-to-serial conversions for parallel data transfer between the adapters and the controller. The line interfacing variations are located outside the CPU for easier restructuring and expansion, according to the vendor.

The CS11-H offers DMA output transmission, Fifo input and adaptability of line interfacing, speed and format selection. Individual byte count and address registers are provided for each line for DMA of characters transmitted from the CPU memory and diagnostic and operating software tran-

(Continued on Page 100)



The CS/11H Multiplexer

Book Series Guides Communications Managers

By Brad Schultz
CW Staff

PHILADELPHIA — A book series for data communications managers was recently released here by Heyden and Son, Inc. under the editorship of Thomas A. Rullo, a Citicorp vice-president and former editorial director of Auerbach Publishers, Inc.

Advances in Data Communications Management, Volume One gathers 10 essays to help managers prepare for the fact that 80% to 95% of DP installations will have data communications this decade, according to Rullo's preface.

Fairly conversational in tone, these articles touch on topics such as network planning, energy considerations in design and procurement, net management per se, protocols, the trend toward open systems interconnection, architectures, fiber optics, satellite links and the status of existing and proposed data communications services.

In "Data Communication System Planning," Pete D. Moulton of the U.S. Senate Computer Center presents, among many other things, sample job descriptions of data network personnel.

The network manager, in Moulton's view, reports to the organization's computer center director. The manager's function is mainly to evaluate require-

(Continued on Page 104)

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FCC Seeks Comments on Conversion Functions

(Continued from Page 99)

issued earlier this month.

The inquiry will not deal with protocol conversions that involve internal network operations — those occurring between entry and exit nodes. It will focus, instead, on the header and trailer codes used to control information flow between the ends of the message path and between the user's terminal and the network.

In a packet-switched network, for example, where a message is divided into frames, each containing one or more information packets, the header/trailer codes, among other functions, show the beginning and end of each frame, identify the receiver's address, detect errors and provide a way of telling the sender, at any time, which packets have been received at the other end.

Although packet-network protocols have been partly standardized, a good deal of work remains to be done. And even after this process is completed, variations will be necessary to support different types of networks and applications. If, as seems likely, AT&T goes into the packet-switching business, it must be able to interconnect these different networks and applications on the same terms as its competitors. Under the computer inquiry decision, however, this is not possible — at least according to one interpretation.

Basic Service

Packet switching is classed as a basic service and thus can be offered by AT&T operating companies but protocol/code conversion is part of an enhanced offering, which Bell can market only through a separate subsidiary. A phone company competitor, by comparison, can integrate both functions into a single service and offer it through a single company.

Many of AT&T's competitors — led by IBM, the Association of Data Processing Service Organizations, Inc. (ADAPSO), Tymnet, and the Computer & Communications Industry Association — strongly oppose letting the telephone operating companies do likewise.

One argument is that although a telephone operating company can not offer an end-to-end packet-switched service requiring protocol/code conversion at the ends of the transmission path, a separate Bell subsidiary can offer such a service (by leasing transmission from an operating company). Thus, the discrimination allegedly imposed on Bell is more apparent than real.

Adapso Agrees

Another argument was provided by Adapso in one of its earlier comments in the computer inquiry. "If AT&T [operating companies are] allowed to perform protocol conversion, then AT&T could selectively choose which protocols and codes it utilizes and thus could destroy the competitiveness of equipment and service offerings of others," it said.

Adapso argued further that letting the operating companies perform protocol/code conversion for the end user would "create immeasurable opportunities for cross-subsidization."

Bell, for example, could load the conversion software into its computerized electronic switching systems, which now support telephone service. By allocating a disproportionate share of the related costs to telephone service — an easy task, given the sad state of telephone accounting systems — Bell could offer protocol/code conversion service for substantially less than its competitors.

Initial comments in the inquiry, formally known as Docket 80-756, are due next March.

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Multiplexer Runs On PDP-11, VAX

(Continued from Page 99)

sparency.

The unit supports asynchronous line interfaces of all types, including RS-232, with full DM11-compatible modem control and current loop.

The system also provides for line parameters such as individual line speeds to 19.2K bit/sec using all commonly used transmission rates, split line speeds; character size from five to eight bits; and stop bits one one, 1.5 or two bits in size. The firmware programmable read-only memory used for the unit directly emulates the DEC DH11 functions, the firm said.

In addition, controller functions can be placed on one board that plugs into a single Unibus SPC slot as only one unit load on the Unibus. The single 34-conductor flat cable daisy chains up to four distribution panels which contain the line adapter circuitry.

The device provides improved performance, up to 19.2K bit/sec per line, with a total composite data rate of 50,000 char./sec on a single controller. Multiple controllers may be used for increased capacity. A 64-character Fifo buffer is provided for each group of 16 received data lines.

A basic configuration of one controller and one distribution panel with adapters for 16 channels, all including modem control, is priced at $5,800. To expand in increments of eight lines, additional panel and an eight-line adapter costs $2,500. To expand in increments of 16 lines, an additional panel and two eight-line adapters is priced at $3,900. A 32-line system would cost $9,700, the firm said from 2001 E. Deere Ave., Santa Ana, Calif. 92705.

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Starwriter Debuts

LOS ANGELES, Calif. — Computer Textile, Inc. has introduced the Starwriter, a letter-quality, receive-only, daisy wheel printer.

The Starwriter runs at 25 char./sec and comes with an industry standard Centronics Data Computer Corp.-compatible parallel interface. The printer uses Diablo Systems, Inc. ribbons and printwheels, has full graphics capability and is completely code-compatible with Qume Corp. and Diablo. No software changes are required to use boldface, underlining and bi-directional printing, the vendor said.

The Starwriter accommodates paper widths of up to 15 in. It costs $1,779 from the firm at Suite 1504, 10960 Wilshire Blvd., Los Angeles, Calif. 90024.

Multiplexers Get Rack Mount DE-4

CHAMPAIGN, Ill. — Compre Comm, Inc. is offering a DE-4 rack mount version of its Data Express statistical multiplexer and a flow control option for its multiplexers.

The DE-4 fits in standard 19-in. equipment racks and can be mounted with or without the cover. It costs $1,625.

The X-on/X-off feature adds protection from data loss during high activity periods and comes free of charge with the vendor's multiplexers, Compre Comm said from 51 E. Chester St., Champaign, Ill. 61820.

Programmer Out For Pals, FPLA

AUBURN, Calif. — A Universal Logic Array Programmer designed to program present and future logic array devices, including Pals and FPLAs, is available from International Microsystems, Inc.

Standard features of the IM3030 include menu-driven software, dual RS-232C ports for interfacing to development systems, switch-selectable transmission rates from 110- to 9,600 bit/sec and selectable 20mA current loop.

The mainframe costs $1,595 and module prices start at $595 from the firm at 11554 C Ave., Auburn, Calif. 95603.

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Bell 212A-Type Modem Runs in Full-Duplex Mode

NEW BRIGHTON, Minn. — An FCC-registered Bell 212A-compatible modem that operates in the full-duplex mode over dial-up lines has been introduced by Multi-Tech Systems, Inc.

Both 1,200 and 0-300 bit/sec capability are provided with asynchronous or synchronous operation selectable in the 1,200 bit/sec mode. The MT212A is available in both stand-alone and rack-mounted configurations and provides originating and automatic-answering capability. Voice-to-data transferring is accomplished with a push button on the modem chassis, eliminating the need for 502 exclusion-key phones.

The stand-alone unit costs $850 from Multi-Tech at 82 Second Ave., S.E., New Brighton, Minn. 55112.

The MT212A Modem

Why Arizona State University decided not to upgrade their mainframe to meet computer demands.

Distributed Processing with Digital. The right system for the job. Every job.

As user demands grow, it can be tempting to get a headstart on future demand by upgrading an existing batch-oriented mainframe. But it's not always the smartest strategy.

For example Arizona State University had been using a mainframe exclusively—both for academic timesharing and for more complex research. So when timesharing demands skyrocketed, their inclination was to upgrade their mainframe.

Instead, they chose a different approach. Distributed processing. A strategy that allows them to solve individual needs and problems with individualized systems. Rather than one single upgrade, they added three dedicated, interactive PDP-11/70 computers. One each for their colleges of Engineering, Business and Liberal Arts. This distributed approach was a much more functional solution to their problems. Not only did it allow them to tailor each unit to its specific application, it gave them flexibility for the future. Now they can add and reassign computers effectively and cost efficiently.

Distributed Processing with Digital means not wasting your mainframe.

"We don't use the PDP-11/70 systems for all our academic applications," explains Darel Eschbach, Director, Computer Center. "But we use them for the very large number of smaller timesharing jobs needed by the various departments on campus. Most undergraduate timesharing is now on Digital's systems. The mainframe computer we now reserve for higher level computing for batch-oriented applications. Thus we've been able to realize an increased effectiveness in the use of all our computer facilities."

James Hershauer, Professor of Quantitive Systems in the Business College likes the interactive capabilities his PDP-11/70 provides. "I estimate that nearly one-third of the students in programming courses have never done anything on a computer. That's why the PDP-11/70 is so valuable. Here are students sitting down to program for the first time in their lives. Perhaps they'll make 10 passes before they have a successful program. It helps them to have the immediate response of the timesharing system."

Distributed Processing with Digital means more availability.

Max Ivey, Director of Academic Computing Services, sees the PDP-11/70 systems solving future demands too. "We do see some probable areas of growing use as in research and statistical applications. Availability is what makes these systems so appropriate for academic use. They're perfectly suited to do the type of work that students do," he concluded.

So when Arizona State opted for distributed

DEC Offers CRT Units For News Applications

MERRIMACK, N.H. — Digital Equipment Corp. has announced a line of CRT terminals for newspaper applications. The VT173/C (for classified advertising) and VT173/R (for reporting) contain an LSI-11/2 microcomputer and offer display and text handling features, the vendor said.

The VT173/R, with 32K bytes of internal storage and 105-key keyboard, costs $5,195.

The VT173/C has 32K bytes of internal memory and 123 keys; it costs $5,995.

DEC is headquartered in Maynard, Mass. 01754.

For Interdata Processors

IEEE Bus Controller Fits PE Gear

NEWPORT BEACH, Calif. — An IEEE bus controller for Perkin Elmer Corp. (PE) Interdata processors has been introduced by MDB Systems, Inc.

The board allows the computers to control programmable instruments, both talker and listener devices, as well as computer-oriented peripheral devices which are configured for the IEEE 488 bus, a spokesman said.

A full-capability controller (C1-C5), the MDB board generates parallel and serial polls, extends control to other intelligent devices and, when switch-enabled, acts as the system controller, according to the firm.

Among its capabilities are a talker function, a listener function, service request, remote/local and parallel poll.

The interface communicates with the computer via the multiplexer and selector channel I/O bus, the MDB spokesman stated.

Standard Interface

The MDB standard interface is contained on a single 15- by 15-in. board that is mechanically identical to the Interdata module and can be mounted in a single slot of the computer chassis.

All function select switches are located on the front edge of the interface board so board removal is not required to change switches, MDB noted.

The standard 24-pin IEEE bus receptacle for daisy chain cabling is also located on the front edge of the board, the spokesman explained.

The controller costs $1,250.

MDB Systems is headquartered at Suite 203, 2503 Eastbluff Drive, Newport Beach, Calif. 92660.

Burroughs CPUs Gain Input Port For Bar Code Data

BLUE BELL, Pa. — The introduction by National Computer Products of an auxiliary data input port has reportedly made it possible for users of Burroughs Corp. computers to enter bar code OCR-A or OCR-B data into a Burroughs computer using a hand-held wand.

Fits ND-830

The port fits on National's Burroughs-compatible ND-830 CRT terminal. It will allow Burroughs users to directly connect a bar code OCR-A or OCR-B reader with an RS-232C serial interface, the vendor claimed.

The scanned information is read directly into the ND-380 and displayed, with the data being treated in the same manner as keyboard entered data, the vendor explained.

The port costs $1,195.

National Computer Products may be reached through P.O. Box 154, Blue Bell, Pa. 19422.

processing, they got several advantages.

First, the PDP-11/70 systems were tailored to their tasks. With interactive capabilities that made it easier for new students to learn. The university was also able to use their new and existing systems in a much more cost-efficient manner, and subsequently installed 3 additional units.

Distributed Processing with Digital means more flexibility.

Distributed processing lets universities like Arizona State evaluate and meet their needs on a simple, year-to-year basis. They can purchase different capabilities as required by different applications, adding and reassigning computers to meet their demands. Which means they'll never have to commit to more (or less) computer than they need.

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Book Series Guides Communications Managers

(Continued from Page 99)

ments for data communications services; determine the organization, staffing, facilities and equipment needed to meet the requirements; plan for upgrades; and evaluate the effectiveness of equipment, personnel and other resources in meeting the network's stated objectives.

To qualify for network manager, an individual needs experience in planning, operation, development and maintenance of large data communications networks, Moulton noted in his essays. Also, the person needs comprehensive knowledge of the products and services available for data networking as well as experience in managing technical people.

The network manager should have seven years professional experience in data communications beyond the experience equivalent to a bachelor's degree. Two years should be in managing.

Reporting to the network manager is the assistant manager who, in Moulton's scheme, assists or fills in as needed and maintains liaison with other computer center sections, occasionally in addition to supporting short duration projects.

Moulton would have the assistant manager possess much the same credentials as the network manager, including a bachelor's degree or five years' professional experience in data communications software and computer system development.

Also reporting to the network manager is the section manager for communications software. This person takes charge of maintenance, documentation and enhancement of the computer center's communications software and leads communications programmers in various projects.

The section manager for communications software need a knowledge of systems analysis and programming methodology, should be a stickler on detail and accuracy, know how to plan and schedule software development and understand real-time software design as well as data communications protocols, equipment and facilities. For this job, five years' professional experience beyond a bachelor's degree is also preferred.

Reporting to the section manager for communication software is the communications software specialist, who is essentially a communications-oriented programmer with an associate degree or at least three years' experience in software development and maintenance.

On a par with the communications software manager and also reporting to the network manager is the section manager for network equipment, Moulton continues. He or she directs installation of all data terminals and monitoring of their performance. Moulton considers an associate's degree or three years of college sufficient.

The network equipment section manager supervises computer terminal technicians and a network equipment coordinator. The latter dispatches and logs all service calls and schedules all installations and moves of equipment.

Another individual reporting directly to the network manager is the section manager for special projects, who is responsible for performance and implementation of special projects aimed at improving network effectiveness and reducing network costs. A consummate data communications professional, this person needs at least six years' background in the business and a bachelor's degree in computer science, engineering, mathematics or natural science.

The special projects section manager oversees communication system specialists, who generally have the same schooling but fewer battle scars. If they don't know it all, they should think they do and gracefully make up the difference.

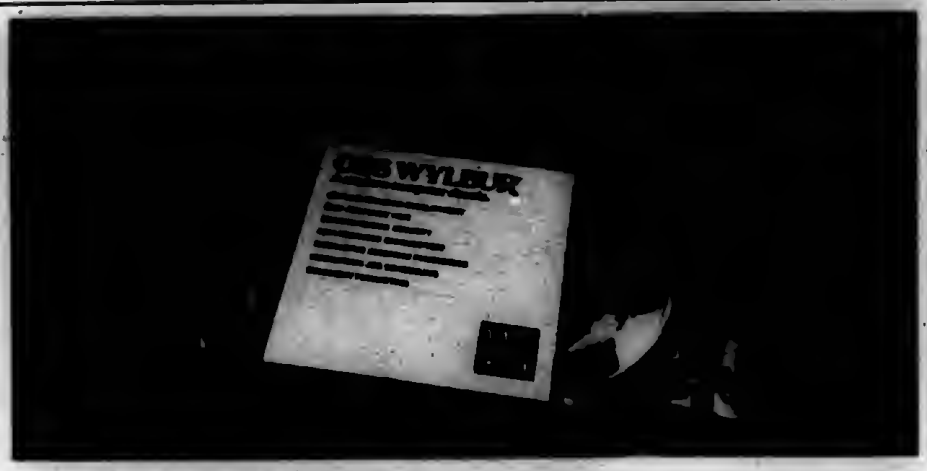
The final job slot reporting directly to the network manager in Moulton's scheme is the section manager for technical control. Responsibility is for operation, maintenance and enhancement of the computer center's technical control facility along with local and remote data communications facilities. This person troubleshoots crises, much like Scotty on the *Starship Enterprise*.

The post's duties include direction of patch-ups, post mortems and scheming for better gear. The technical control section manager needs savvy in both analog and digital communications and an ability to lead people. Education should approximate a communications-related bachelor's degree.

Reporting to the section manager for technical control is the communication engineer, senior network technician and network technician. The communication engineer is there to size up sudden problems and direct the technicians in solving them. All three can make good with a high school diploma and a six-month stint in an appropriate trade school, Moulton suggested.

Advances in Data Communications Management, Volume One also features useful descriptions of most well-known network architectures, protocols, packet-switched circuits, network architectures, protocols, packet-switched circuits, network services and links that leave the Earth.

More information on this book, *Advances in Distributed Management, Advances in Computer Security Management* and other books in the series edited by Rullo, is available from Heyden & Son at 247 S. 41st St., Philadelphia, Pa. 19104.



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With On-Line Communications

State Auditor Ends Conflicts Between Users, DP

By Richard W. Beddow
Special to CW

HARRISBURG, Pa. — On-line data communications techniques in use at the state's Department of the Auditor General here have brought rising DP-costs under control while meeting increased DP requirements.

Within the past 18 months, Auditor General Al Benedict has been able to eliminate the problems and conflicts associated with priority setting between user areas and central data processing, greatly improving turnaround time for user requests and avoiding duplication of costs through common applications and sharing. At the same time, Benedict has responded to the unique requirements of the individual user bureaus in meeting the department's objectives.

The Bureau of Management Information Systems (MIS) utilizes a Univac 90/30 mainframe with a main storage of 256K bytes, five Univac 8418 disk drives with a total capacity of 290M bytes, three Uniservo 16 magnetic tape drives, a card reader and printer.

Also part of the system are two communications lines, a Univac UTS 400 microprocessor-based CRT terminal with a 64K-byte memory, a printer and a floppy diskette, as well as four UTS 400 terminals and three attached printers.

The department has 22 bureaus, all of which can request priority status for certain projects. However, only four bureaus (Comptroller's Office, Bureau of Personnel, Bureau of Communications and Bureau of Public Assistance Audits) warrant top priority status on the majority of their requests.

Previously, priority requests sometimes disrupted operations scheduling and could force postponement of a batch run. That, in turn, could result in a need for third-shift or weekend processing.

Moreover, priority requests seemed to arrive at the most inopportune times — such as when another priority request was running.

Major Problems

The major problems encountered were operations scheduling, slower turnaround time for nonpriority projects, increased workload on analysts, programmers, data entry and computer operators and changing priorities among jobs.

The solution was found by providing on-line capabilities to the four prime bureaus and also to five others, which resulted in a significant amount of time, responsibility and workload taken away from data entry and operations and returned to the user.

One of the key benefits is that users are no longer forced to compete for priority status among the various operations and audit bureaus and can schedule their own sessions and set their own priorities independent of other bureaus and MIS schedules. Simultaneously, the computer is now free to process other applications.

The advantages are twofold. Not only have the user bureaus helped, but the computer center no longer needs to modify its operations schedule for the shifting priorities of those projects currently on-line.

Furthermore, much of the data entry and verification activity associated with production runs has been eliminated since control was returned to the bureaus. (It should be noted that audit trails on data entry and reports are generated and routinely checked.) Data entry staff is minimal, with emphasis placed on new systems development.

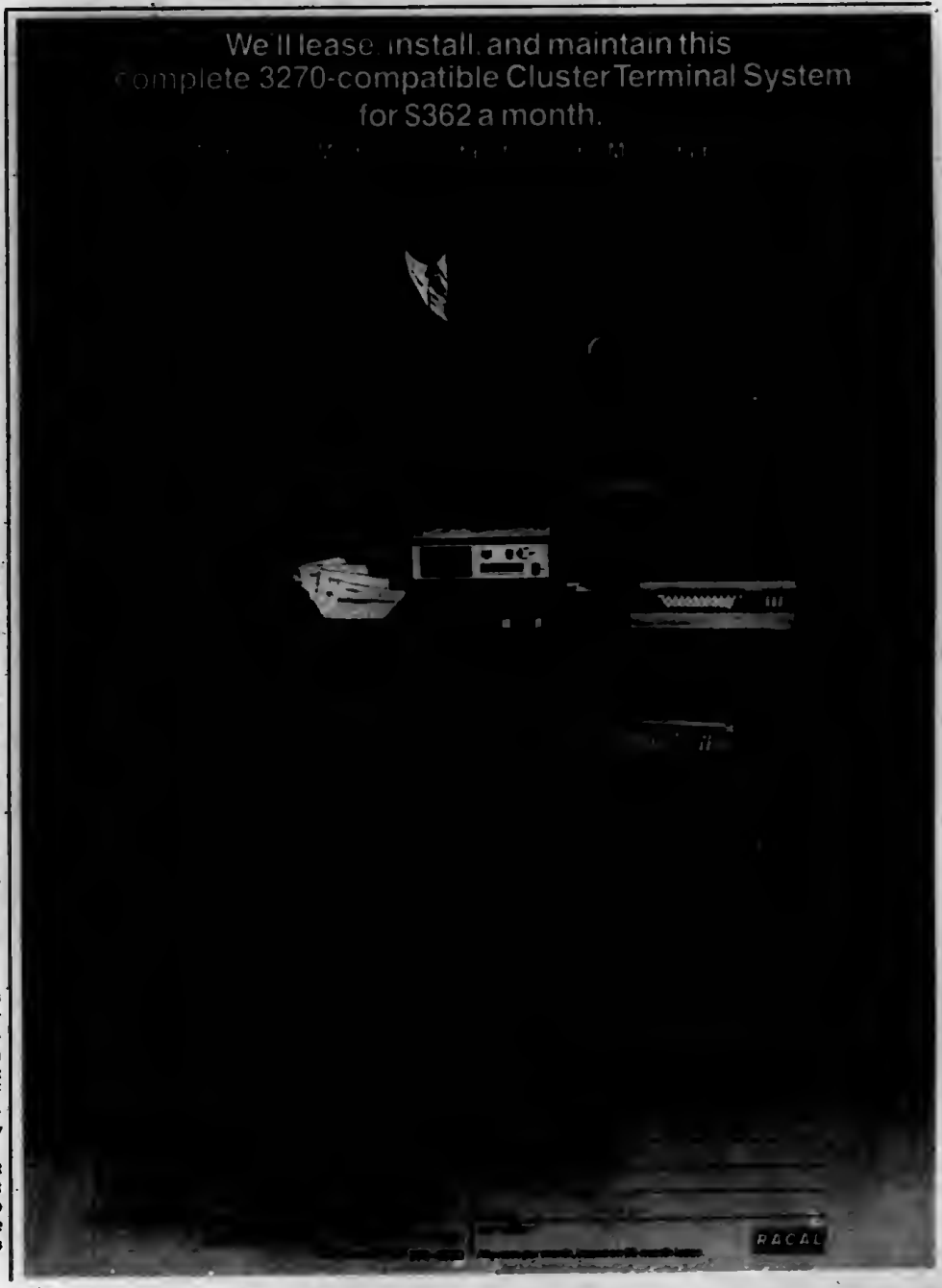
The Auditor General's initial approach was to develop on-line applications for a few key user bureaus with the communications network tied directly into the host computer. Once the applications were released into a production environment and the users became more aware of the computer's potential, their appetite was only whetted for additional on-line development.

To meet these increased demands, all terminals currently being ordered are intelligent and will function as microprocessors. Data being entered during updates will be immediately verified by the microprocessor and will relieve the host computer of this responsibility. Disk storage and printer terminals will also be included within the systems configuration for each of the key bureaus.

Through the application of on-line communications processing techniques, the computer's processing power has become more accessible to the individual bureaus. The planned installation of additional terminals will further extend the Auditor General's ability to more efficiently respond to his increasing mandated responsibilities.

Currently, all users that are on-line are in-house. However, in the near future, the department will be linking a remote site containing four users into the system; in the more distant future, on-line capabilities will be provided to certain field offices through the Commonwealth.

Beddow is the director of MIS with the Department of Auditor General, Harrisburg, Pa.



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Touch-Sensitive CRT Units Quiet Library Access Woes

Special to CW

EVANSTON, Ill. — The Evanston Public Library has long been a leader in making its resources available to the public it serves. In 1896, the library began using a card catalog based on the newly established Dewey decimal system of classification to replace cumbersome "finding lists." In 1920, it became the first city library to employ a bookmobile.

Then, this fall, the library began replacing its traditional card catalogs with touch-sensitive CRT terminals. The new terminals let library patrons access more than one million entries in the library's catalog, including books, records, cassettes and films.

Unlike most terminals, the touch-sensitive terminals do not require keyboards. Each terminal screen is divided into a number of areas, each one displaying a particular information category. When a library user touches the area corresponding to the type of information he wants, the information is displayed in large bright characters on a large screen.

Designed for use by people unfamiliar with computer equipment, the terminal screen guides patrons through their choices. The user initiates a search of the library's holdings by touching with a fingertip one of three categories (author, title and subject) displayed on the screen. In doing so, the user begins to access the on-line data base of the library's host computer.

After this initial selection, a list of key words appears on the screen from which the user selects the one preceding the desired entry. As the process is repeated, the search is narrowed until the desired entry appears. The user can then obtain full information about the particular selection, including its location and availability.

Favorable Reports

In use since October, the terminals are getting favorable reports from the library's users. According to Jane Greenfield, adult services coordinator for the library, patrons making use of the new on-line information system can get more complete and more current information than was possible under the traditional catalog system.

Users interested in a particular title, for example, can learn from the terminal whether it has been checked out and whether other copies can be obtained at one of Evanston's three branch libraries. Some patrons have even done empirical research, first checking out a book, then running back to a browsing terminal to see if the check-out had been recorded on the system.

The touch-sensitive terminals are currently installed in the library's main lobby, the reference room, the art room and the children's room. While some of the library's adult users at first hesitated to make use of the browsing terminals, younger patrons have been enthusiastically exploring its capabilities from the start.

According to the library's public relations coordinator B.J. Jahnke, "It has been fun to watch children line up to use the terminals. They are totally thrilled with its possibility, and we've found in our suggestion box comments like 'absolutely fantastic.'"

Designed to be "patron-proof," the terminals have no exposed switches, wires, dials or knobs to intimidate users. According to Greenfield, the terminals are actually more resistant to damage from users than the library materials they help users locate.

Once library users have become accustomed to using the new terminals, the old card catalog will be eliminated. "Initially, having both versions of the catalog let our users become accustomed to on-line catalog at their own pace," Greenfield noted. "For some people, that made the transition more pleasant."

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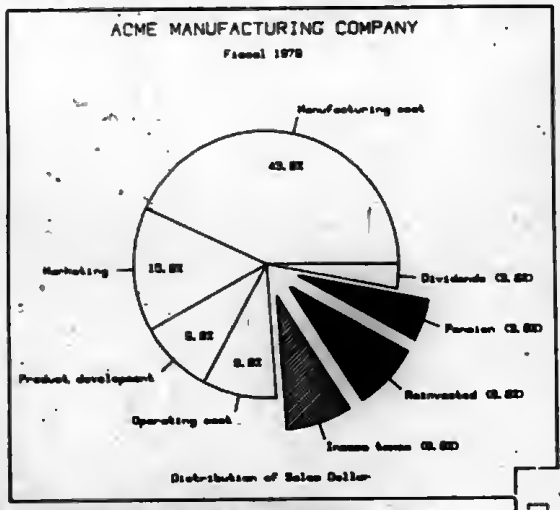

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IBM Constructs Superconductors To Push Limits

YORKTOWN HEIGHTS, N.Y. — Scientists at IBM's Thomas J. Watson Research Center here have constructed experimental superconducting magnetic sensing devices whose operating characteristics reportedly approach limits imposed by fundamental laws of physics.

When incorporated in complete measurement systems, the devices could permit measurement of changes in magnetic fields as small as one millionth of a millionth of the field of the earth when those changes occur at frequencies above 10 KHz. This represents a 100-fold increase in sensitivity over existing commercial measurement systems that use similar magnetic sensing devices for a range of application areas that includes geophysics, biomedicine and pure science.

The devices belong to a family of superconducting quantum interference devices (Squid), which employ superconducting metals that lose all electrical resistance at temperatures close to absolute zero (273° below zero Centigrade). Squids have been used in measuring variations in the magnetic field at the earth's surface, which is important in searches for geothermal energy sources and minerals and possibly in earthquake prediction. They have been used in detecting heart and brain waves (magnetocardiography and magnetoencephalography).

Squids have also been used to make voltage comparisons to one part in 100 million and current comparisons to one part in one billion. In addition, Squids have played roles in attempts to detect gravity waves and in searches for quarks, fractionally charged particles believed to be the building blocks of elementary particles such as neutrons and protons. They have also been used in studies of magnetic materials. Significant improvements in Squid performance thus have, potentially, both practical and scientific importance.

Advances Reported

The advances discussed here were reported to the worldwide scientific community by several IBM research groups beginning early last year and have stimulated further work at IBM as well as else-

(Continued on Page 112)

Drafting System Replaces Light Tables, Tracing Paper

Special to CW

SAN JOSE, Calif. — Light tables and tracing paper have made way for a computer-based drafting system here at an architectural and construction firm that specializes in electrical applications.

David M. Arrigoni & Associates, Inc.'s graphics computing system is currently built around six Tektronix, Inc. computers and reportedly tripled the speed of electrical and lighting system design. The system can not only lay out the entire floor plan of multilevel buildings, but it can accurately estimate the cost of a particular job in as little as four hours, according to David Arrigoni, the company's president.

Before installing its system, the firm used the usual manual procedures for designing and producing electrical drawings. An architectural drawing of a floor plan was placed on a light table and traced. A blueprint was made from the tracing and marked up by an engineer to show the location of electrical fixtures and wiring. The marked-up copy was given to a draftsman who used it to draw a bid document. Schedules and details were typed or drawn on a clear adhesive paper and stuck down on the drawing.

A typical job might involve 12 to 20 of these drawings, and take anywhere from 700- to -1500 man-hours, Arrigoni explained.

Too Slow

"The manual system was just too slow for the productivity we needed for growth," he said. "And the time-sharing system we were using for business applications didn't have much of a graphics capability. Besides, it had a number of accessibility and downtime problems."

Currently, the company's system consists of the processors, six 1.3M-byte Tektronix 4907 dual-density floppy disk units, three 4663 plotter-digitizers, a 4631 hardcopy unit, a 4924 magnetic tape unit and other plotting devices. The firm does all of its programming for the system in Tektronix' Extended Basic.

The company took the first step toward developing its own computerized design system about two- and one-half years ago, when it installed a Tektronix 4051 graphics computing system, a stand-alone computer with an 11-in. CRT terminal screen. According to Arrigoni, the firm chose the 4051 after a lengthy evaluation process and a benchmark in which the system proved to be twice as fast as its nearest competitor.

It was not until the Tektronix 4907 file management system was announced, however, that the firm began to develop in earnest an electrical design system utilizing the system's graphics capabilities.

Today, the floor-plan system is largely computerized, using several design and production workstations. At the design station, an architectural drawing is placed on a 3- by 4-in. digitizer, where a hand-held cursor is used to enter the drawing into the computer. First the floors and walls are digitized in, then the doors and windows. Doors, for example, are entered into the computer by us-

(Continued on Page 110)

Honeywell 316s Get Nonvolatile Disks

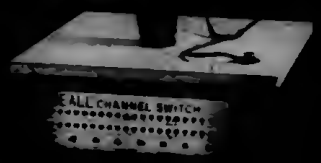
REDWOOD CITY, Calif. — Ampex Corp. is now offering an all-electronic nonvolatile disk replacement for Honeywell, Inc.'s H 316 computers that it claimed will improve and upgrade performance.

The Ampex Megastore 316 is available in 512K-byte (256K words) and 1M-byte (512K words) capacities. Two I/O mode options are provided, the firm said. The unit will operate directly through the direct multiplex control or as a program input/output device. Operating with no latency time and optional transfer rates of 19KHz to 297 KHz, the unit offers the flexibility to fit most applications, according to the vendor.

Data word length of the unit is 16 bits and data is transferred to and from the unit in 16-word sectors, with a single transfer being any number of sectors from one to 2,048. Each unit is installed with a write-lockout feature consisting of 16 switches and indicators. Depending on the specific unit's size, each switch, when set in the ON position, protects a group of tracks from being written. The 256K word unit protects 64 tracks in four-track increments while the 512K word device protects 128 tracks in eight-track increments.

The Megastore 316 comes complete with controller, power supply and interconnecting cables and costs $11,000 for .5M-byte and $18,000 for 1M byte. Ampex is located at 401 Broadway, Redwood City, Calif. 94063.

Instant Cure for Computer Indigestion



John Beall & Company, Inc.

Janitorial Firm Cleans Up

Cost, Pricing Control Motivates Switch to DDP

SAN FRANCISCO — American Building Maintenance Industries (ABM) went from decentralized processing to distributed data processing (DDP) in order to control costs and establish realistic prices in a labor-intensive industry, according to R. David Anacker, executive vice-president.

ABM provides janitorial and a variety of other building maintenance services to companies in the U.S. and Canada. Employing approximately 20,000 people, its clients contract for maintenance services, mechanical services, energy management, air filters, elevators, engineering, parking management, pest control, linen and sanitary supplies, security, signs and lighting, a spokesman said.

"People tend to look at us as providers of services necessary for their business to function," Anacker noted. However, the ability to win contracts and make profits is based upon our being able to remain competitive and that requires information, he said.

"If one of our subsidiary companies, for example, is asked to bid on a janitorial maintenance contract, there are multiple factors that would affect a cost-effective bid," Anacker explained. Included among these would be current and projected labor costs, special trash removal requirements and vehicle scheduling in order to bring equipment and personnel to the job, he said.

While the answers to all of these questions can often be found in the accumulation of ABM's experience, it is essential to make that information available where and when needed, he said.

Until 1973, when the federal government enacted wage and price controls that required extensive documentation, the necessary data was not available in any central processing system, Anacker noted.

The first tentative steps were taken toward DDP in early 1976 when Beind Bremer, director of management information systems (MIS), consolidated three separate DP systems operating in San Francisco and Seattle. They were replaced by an NCR Corp. N-8450 computer at ABM corporate headquarters in San Francisco. The system was upgraded to an NCR V-8550 and that, in turn was replaced by Model V-8555-M, Bremer said.

"We took advantage of NCR's migration path enineering to gain the power and memory we needed as we began building a data base to perform the routine applications our companies use today. Simultaneously, we laid the groundwork for a true DDP system," he continued.

The current configuration is a multiprocessor that employs Virtual Resource Executive (VRX) firmware to handle a remote job entry (RJE) network of data display terminals and impact printers with a 1.5M-byte mainframe.

Although ABM needed to provide local managements with a system for controlling data entry that allowed for allowed for timely information retrieval, it was impossible to implement it all at once, Bremer noted.

Critical Point

The initial applications were the most criticle and included payroll, accounts payable and receivable, job costing, general ledger, workers' compensation and stock option plans. "Getting these programs going allowed us to begin building a data base that could serve both central and local management," he said.

Data entry and retrieval was initially handled off-line with companies keying entries to disk and transmitting to the corporate offices via teletype, he explained. The information was transferred to computer tape and used to updated the various files involved, he said.

Some processed data was transmitted back to the local companies for check printing while management reports generated from the same data were printed at the corporate computer center and delivered by courier service.

By mid-1979, some 30 ABM offices were using the central computer resource for data processing. The first RJE data display and printer terminals were installed in departments at corporate headquarters in Sacramento and Fresno, Calif.

Installations at other ABM companies in Phoenix, Albuquerque, N.M., Seattle, Los Angeles and Denver were slated for completion in early 1980 and by the beginning of 1981 Bremer estimated that some 40 RJE stations would be on-line.

The overall plan is to develop programs that allow companies to link into the central computer while maintaining individual identities, Bremer said. Each organization has its own way of doing things due to such factors as different union rates, state laws and unique company histories, he said.

Bremer allows programmers and systems analysts free access to computer time for developing software because this encourages the programmers to use hands-on experimentation.

While some auditors might not approve of this use of computer time, he feels thet the policy has paid dividends in creative programming for ABM.

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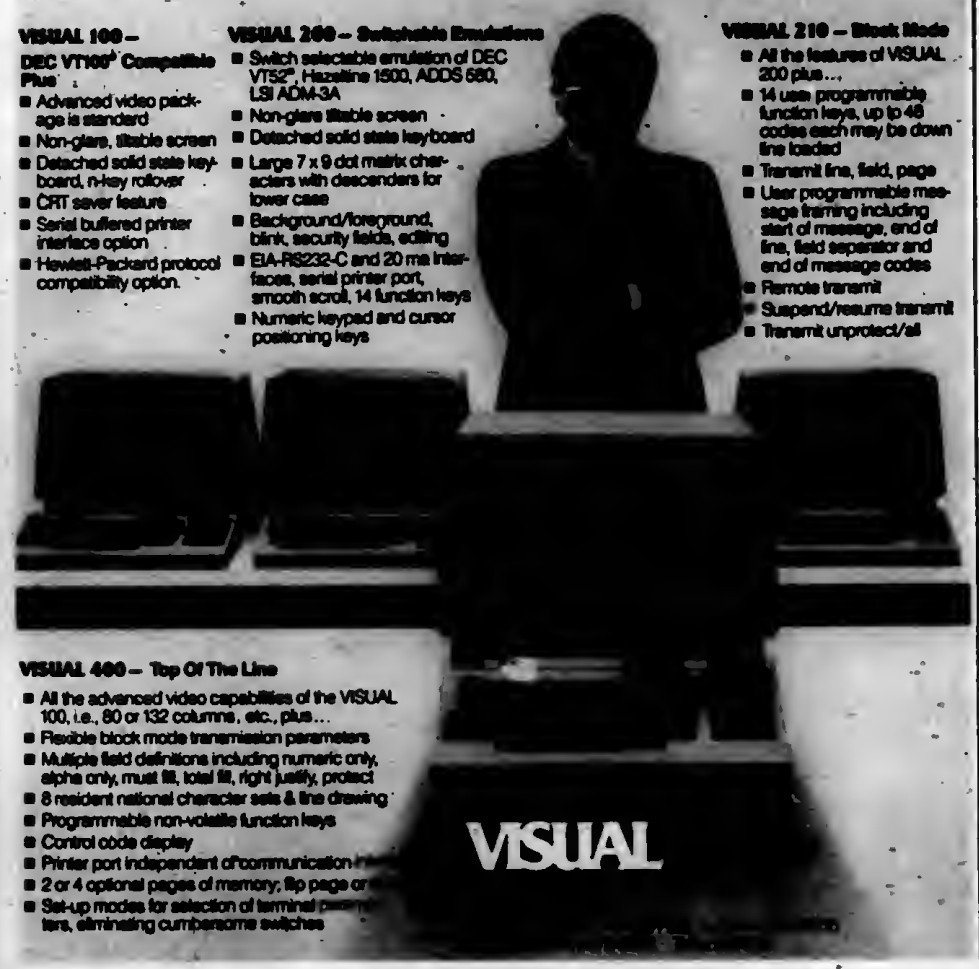

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"We switched to NCR."

Frank J. Sanzone, Jr., Carroll County General Hospital

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Drafting System Replaces Light Tables, Paper

(Continued from Page 107)
ing the cursor to indicate the hinge side, the latch side and the direction the door swings.

The system makes it possible to specify distances and door or window types and will automatically insert them at the proper locations in the walls. Once the floor plan has been entered, it is stored on floppy disk, from which it can be rapidly reviewed on the 4051 CRT terminal screen.

A series of plotter-printed "menus" representing the control commands (such as delete, erase, rotate, add, pen selection and so on) and the electrical symbols stored in the computer are positioned on the digitizer next to the drawing and the computer is told which menus are up and where they are located.

The user touches the digitizer cursor to the appropriate control commands and symbols and then touches the point on the drawing where the symbol is to be inserted. The user can bring the drawing up on the CRT terminal screen and zoom into any particular location to make sure that the operation was successful and that the symbols were included in the appropriate places.

After all the symbols have been entered for a particular drawing, the disk is taken to a production workstation, where the drawing is plotted out on one of the company's four plotters, Arrigoni said.

Though the computerized graphics system was originally designed for electrical engineers, Arrigoni points out that it can be used by engineers in many other disciplines, as well as by architects, interior designers and facility planners. In fact, the system has performed so well that Arrigoni plans to market it to other engineering firms.

Arrigoni recently enhanced the overall ease of use of the system with several hardware inventions of his own. The firm designed a special box that moves the CRT terminal cursor using two separate knobs. The box allows the user to move the cursor in either the X or Y direction with no drift.

He also has developed a special menu light system for attachment to the digitizer. The lights, which are positioned behind the menus on the digitizer, help the user remember which control commands are in effect.

'The system makes it possible to specify distances and door or window types and will automatically insert them at the proper locations.'

For the future, Arrigoni is in the midst of developing a "scratch pad" station to provide even greater design flexibility. This station will be built around the digitizing capability of the Tektronix 4663 plotter-digitizer, several more of which are on order. The firm is also acquiring two Tektronix 4054 graphics computers that feature 19-in. screens.

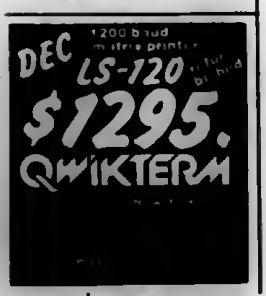
Pilgrim Offers Power Device

PLAINVIEW, N.Y. — An ac power conditioner said to protect microelectronic equipment from voltage spikes, transients and radio frequency interference has been introduced by Pilgrim Electric Co.

The Voltector Series 6 is based on an Electromagnetic Compatibility Analysis and Design (Emcad) Worst Case EDP Computer Analysis for compliance with FCC regulations.

Available with single, duplex or triplex outlets and with continuous current ratings of two to 20 amps, Voltector prices start at $99.

Pilgrim Electric is located at 29 Cain Drive, Plainview, N.Y. 11803.



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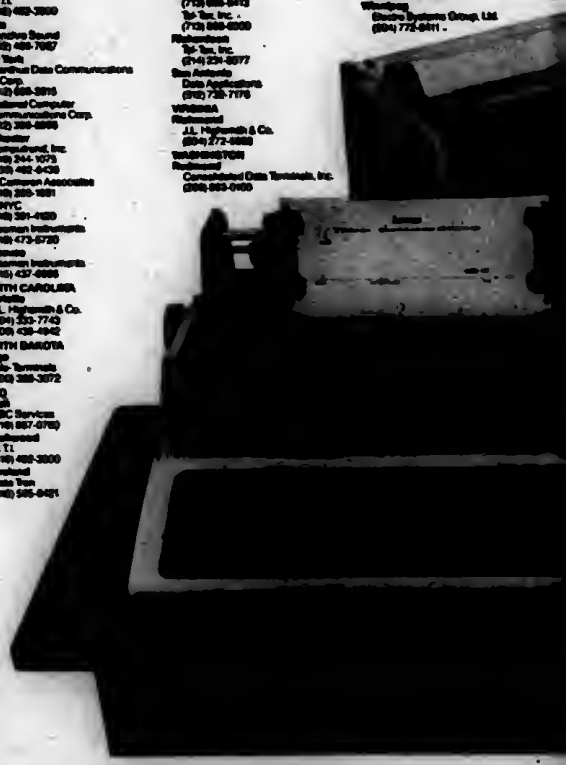

Interactive, Color Raster System

Scaled-Down Whizzard Offers CAD/CAM

SAN DIEGO — Megatek Corp. today introduced an interactive, line drawing color raster display system that is a scaled-down version of its Whizzard 7250 system introduced earlier this year.

The Whizzard 6250 system incorporates many of the features of the large-scale 7250 raster display system, but is designed to be an entry-level computer-aided design (CAD) and computer-aided manufacturing (CAM) device.

The 6250 has a 13-in. color display monitor rather than a 19-in. model and up to 64K bytes of vector memory instead of the maximum 192K bytes offered by the firm's top-end computer.

The 6250's 14-slot chassis includes a graphics processor, the vector memory, an RS-232C serial asynchronous interface and room for option modules, a spokesman said.

Options include additional memory, a hard copy output interface and a data tablet input interface.

Although the 6250 does not include some of the 7250's sophisticated features such as a three-dimensional picture, a user-definable character set and a black and white graphics option, the system is priced nearly 50% less than its older brother. The cost of the system, with basic software, is $17,500, the spokesman noted.

Although the system is geared for general business applications, it can be fitted with the firm's Template computer graphics software, which can be used to generate charts, graphs and other descriptive displays, the spokesman explained.

System Features

Features of the 6250 include the Whizzard Graphics Engine, which accomplishes full vector processing and hardware transformations, a double-buffered memory that allows the user to simultaneously display different parts of memory and a real-time zoom and pan feature that allows detailed examination of circuit and architectural displays.

The 6250 has a writing time of 160 nsec and it updates and manipulates complex pictures 20 to 30 times per second, the spokesman continued. The system's monitor uses a long-persistence phosphor to virtually eliminate screen flicker, he claimed.

Finally, the 6250, like the 7250, has a virtual vector space size that is said to provide a high level of detail in real-time steps, a key feature in the raster display market, the spokesman said. The system also offers a bit slice architecture microprocessor that, together with the basic Wand 6200 software, provides a high level of intelligence in the unit's remote terminal, reducing the amount of communications traffic with the host computer.

The 6250 is scheduled to be shipped in February. Additional information on the unit and the firm's other graphics systems can be obtained from the company at 3931 Sorrento Valley Blvd., San Diego, Calif. 92121.

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Yet while it's small, its performance isn't. Digital's terminal prints the full ASCII character set; gives you switch selectable 110 and 300 baud rates; a 45 cps catch-up rate so you get true 30 cps throughput—ideal for most business applications. The printer operates full duplex, or full duplex with local echo.

Plus, it comes with EIA RS232C interface for use with all popular modems and acoustic couplers.

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Take a few seconds to snap in the tractor feed option, and the Model DA handles continuous forms, in up to four parts.

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In addition, the Model AA offers 212 modem compatibility, international character set printing, plus super and subscript printing with roll or sheet fed paper. Keyboard selectable features include parity, local echo and last character visibility so the printhead moves aside as desired.

With both the Model DA and AA, characters can be condensed to 16½ per inch so you can get 132 characters across an 8½ inch sheet for paper and filing economy. Characters can be expanded to 5 per inch with the AA or 10 per inch with the DA.

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Superconductors Push Limits of Natural Laws

(Continued from Page 107)
where. The work relates to Squid devices made using several different technologies.

Fabrication of the "Josephson tunnel-junction" Squids relies heavily on technology developed in the long-term IBM research effort to build a laboratory prototype superconducting computer that uses related Squid devices in experimental memory and logic circuits. Those lead-alloy tunnel-junction Squids, designed and studied by researchers Dr. Mark B. Ketchen and Dr. Richard F. Voss, showed less noise by a factor-of-30 than the previous best example of such a device.

This performance has recently been equaled by a tunnel-junction Squid made with a different technology based on superconducting niobium that, moreover, exhibits exceptional durability, according to IBM researchers Voss, Dr. Robert B. Laibowitz, Dr. Stanley I. Raider and Dr. Christina M. Knoedler and Dr. John Clarke of the University of California at Berkeley.

Yet another Squid technology involves IBM's recently achieved ability to construct the world's narrowest metallic stripes (as little as 8 nanometers wide) with high-resolution, electron-beam lithography. The resulting ultrasmall "nanobridge" Squids, also fabricated out of superconducting niobium, display a factor-of-two improvement over the tunnel-junction Squids when measured at a temperature of 4.2° above absolute zero. This was the work of Voss, Laibowitz and Dr. Alec N. Broers.

The Squids discussed here consist of two Josephson elements connected together in a thin-film ring of superconducting metal. Each Josephson element has two superconducting electrodes that are separated by a "weak link," either a very thin layer of insulator that is placed sandwich-like between the electrodes (to form a tunnel junction) or an ultrasmall superconducting stripe connected between coplanar electrodes (to form a nanobridge).

These weak links give rise to so-called Josephson coupling effects by allowing supercurrents of electron pairs to "tunnel" or pass from one electrode to the other, up to some maximum supercurrent.

Squid operation is based on such Josephson tunneling and magnetic-flux quantization. In the latter phenomenon, when a superconducting ring is placed in an external magnetic field, supercurrents are set up in the ring such that the net magnetic flux (magnetic field times area) through the plane of the ring takes on values that can only be integral multiples of a fundamental unit of magnetic flux called the flux quantum.

The essential point, according to the researchers, is that fields external to the Squids affect the supercurrents through them: The fields change the maximum amount of supercurrent that can exist in the Squids. Currents greater than this critical supercurrent cause Squids to enter the nonsuperconducting or voltage state.

In a complete measurement system, an input coil is used to extend the versatility of the Squid for measurement of quantities such as voltage and current as well as to optimize magnetic-field measurements. Overall system performance, or sensitivity, depends on the input circuit as well as the Squid. Achievement of near-ultimate low noise levels in Squids consequently increases the importance of optimizing the input circuit for the purpose of improving overall system measurement sensitivity.

MIT Input Scheme

IBM researcher Ketchen, together with Jeffrey M. Jaycox, an MIT graduate student working at IBM, most recently reported such an optimized input coupling scheme. They devised and tested a method for lithographically constructing a lead-alloy thin-film multiple-turn coil directly above a Squid loop.

Noise is the ultimate limit to the sensitivity of a Squid sensing device. It can result, for example, from random motion of electrical charge produced by thermal agitation at elevated temperatures. Even at absolute zero, noise still exists as so-called zero-point fluctuations, a manifestation of the uncertainty principle of quantum mechanics.

The IBM researchers showed that the noise in the niobium nanobridge Squid is only somewhat greater than the limit set by fundamental physical theory.

In agreement with circuit theory, Squid noise reduction was a result of decreased size of the Josephson elements as well as optimization of circuit parameters. The cross-sectional area of the weak links in the nanobridge Squid — that is, the cross-sectional area of the metallic stripes — was 0.001 square micrometers. For the lead-alloy tunnel junctions, the weak-link or insulator area was 10 square micrometers. Finally, for the niobium tunnel junctions, the weak-link area was 1.0 square micrometers.

The reported low-noise behavior has been demonstrated only when magnetic-field changes occur at relatively high frequencies (10 kHz to 100 kHz). At sufficiently low frequencies, performance of all devices is degraded by the presence of so-called 1/f noise.

Measurements of the 1/f noise have been made for the lead-alloy Squid by Ketchen and Dr. Chang C. Tsuei. This noise was found to be comparable to that in commercially available Squids, indicating that the strength of the IBM Squids is in their higher frequency.

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Ontrax Unveils 136M-Byte Winchesters

By Tim Scannell
CW Staff

SUNNYVALE, Calif. — Ontrax Corp. last week unveiled a series of 8-in. Winchester disk drives that offer up to 136M bytes of storage, a capacity said to be more than 65% greater than the present highest capacity 8-in. disk drive.

The Ontrax drives are available in three models, ranging from a two-platter 34M-byte version to the highest capacity unit, a five-platter model. They are competitively targeted at drives marketed by Control Data Corp., Century Data Systems, Inc. and Ampex Corp. The Ontrax offerings, however, are particularly aimed at Fujitsu, Ltd.'s 84M-byte 8-in Winchester drive which is the previous capacity king-of-the-hill, according to Jim Snow, the firm's vice-president of marketing.

The high-capacity Winchester drives are designed to be used with medium to large-scale minicomputer systems, whose company includes such 32-bit heavyweights as Digital Equipment Corp.'s VAX-11/780 and Data General Corp.'s MV/8000.

All of the disk units incorporate a patented digital head positioning device that requires no magnets — standard equipment in most conventional disk units — and reportedly eliminates the drive's servo head, servo arm, servo surface or servo read channel.

The drives will be marketed initially on an OEM basis by the one-and-a-half year-old company, but will be sold to end users sometime in the first quarter of next year, Jim Snow, the firm's vice-president of marketing, stated. Initial orders for the system will be taken in February, with shipments scheduled for March and April.

Drive's Heart

The heart of the Ontrax Winchester disk drive is the head position actuator, which not only costs about a third less but is said to be more accurate than present rotary actuator devices. The actuator is made up of nine concentric elements, each embedded with a solenoid coil. The elements — which vary in width — were designed to allow the actuator to cover 512 physical locations on the disk. Using a telescoping motion, the actuator moves the head to the correct position for a read or write operation, Snow said.

Unlike rotary actuator devices, which move the drive's head across the entire width of the media, Ontrax's actuator assigns each of the nine rings to a specific number of tracks and locates disk positions through varying combinations of these elements. The ring design not only allows for narrower disk tracks and, therefore, more storage, but is conducive to experimental thin-film head technology, Snow claimed.

To correct variances in head positioning due to temperature or other operating conditions the drives employ a "squeeze coil" that actually fine tunes the device and makes small corrections to insure an equal spacing between each track, he added.

All of the drives, except the 34M-byte model, have two positioning devices installed at either end of the disk drive to cut access times and to keep up with the higher speeds of minicomputers like those in the 32-bit word-size range. The disks also have a platter speed of about 4,878 RPM, which is approximately the same rate offered on present 14-in Winchester units. Present competing 8-in disk drives have speeds ranging from 2,400 to 3,600 RPM, Snow noted.

The three Ontrax drives have a data rate of more than 9.2M bit/sec and record data at 7.158 bit/in.

Detachable Controller

The 8-in units incorporate a detachable microprocessor-based controller with 16 I/O slots. The controller, which uses Motorola Corp.'s M68000 chip, has a memory card containing data buffering and processor instructions, a storage port interface and a communications port interface. The additional slots handle user-specified interfaces, cartridge or streaming backup systems, and can be used to link the device to an Ethernet office automation network. Under Ethernet, the disks can be used as storage nodes on the user's information line, Snow explained.

The controller's intelligence also handles backup chores for the Winchester device, relieving the processor of that duty, he said. Up to four drives can be used with one controller card.

Although end-user prices for the disk drives will not be released until early next year, the units will sell on an OEM basis for $5,500 in quantities of 250 to 500 units. The OEM price for the disk drive without the controller is about $4,000, Snow stated.

The drives will be maintained directly by Ontrax or by a third-party contractor, depending on the location of the customer.

Ontrax is located at 611 Vaqueros Ave., Sunnyvale, Calif. 94086.

Decsystems Get Controller, Printer Line

MENLO PARK, Calif. — A plug-compatible controller and line of printers for Digital Equipment Corp. Decsystem-10 and Decsystem-20 users are available from BDS Computer Corp.

The LPC-20 microprocessor-based controller handles printers with speeds of 300, 600, 900, 1,200, 1,500 or 1,600 line/min, compared with DEC's controller, which services 300- or 1,200 line/min printers, according to the firm.

The LPC-20 is said to be fully software-compatible with the Tops-10 and Tops-20 operating systems. It controls any of BDS' line printers from 300- to 1,800 line/min requiring only jumper or cable modifications, a spokesman said.

The LPC-20 controller costs $6,500. Printing systems range from $10,250 for a 300 line/min device to $33,500 for 1,800 line/min units. BDS is located at 1120 Crane St., Menlo Park, Calif. 94025.

Controller for Unibus Performs DMA Transfers

ORANGE, Calif. — MDB Systems, Inc. has announced a controller module for Digital Equipment Corp. Unibus computers that reportedly performs DMA data transfers to and from byte-oriented peripherals such as printers, plotters, graphics terminals and plasma displays.

The MDB PDI-11 offers PI/O compatibility. On a PI/O basis, the PDI/11 allows a peripheral device to appear to the computer like a DEC DL serial line unit.

This means the user can integrate the product into the system and run a peripheral with existing software while DMA software is being developed and integrated, the vendor claimed.

The price for the unit is $2,150, the vendor said from 1998 N. Batavia St., Orange, Calif. 92665.

DG Offers Backup Drives

WESTBORO, Mass. — Two reportedly compact and low-cost tape drives designed for disk backup storage have been introduced by Data General Corp.

Model 6123 for Micronova systems and Model 6125 for Nova and Eclipse systems use streaming technology and 1,600 bit/in. recording density, a spokesman said.

Designed to address the "Winchester backup problem," according to the spokesman, the tape drives allow users to back up the contents of a 25M-byte disk on one 8.5-in. reel of tape.

Model 6123 costs $6,600 and Model 6125 costs $6,800.

DG is located at Rt. 9, Westboro, Mass. 01581.

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Small Business Systems Speed Insurer's Claims Work

BOSTON — By installing small business systems in some of its branch offices, Liberty Mutual Insurance Co. has speeded its processing of worker's compensation claims by 45% and increased accuracy by 75%.

Prior to installing the systems, new clerical personnel had to be hired whenever the information handling load increased, according to Bob Taylor, manager of technical research at the company's Boston headquarters.

Traditionally, Liberty Mutual clerks identified which claim a piece of mail was related to through the use of master index cards. The cards listed alphabetically all the employers covered by Liberty Mutual. The employer's card would be followed by cards on each of their employees who had a claim.

This manual system required many clerks scanning hundreds of index cards to match the claimant's name with the policyholder's name. A piece of mail might pass across 15 desks before a match was made, Taylor said. If clerks came up empty-handed, the company had to write back requesting additional information.

As a result, it would often take from four- to six weeks to complete the file on a claim and finally get a check into the mail.

Index System

Last fall, the Dallas and Houston offices each installed a Texas Instruments, Inc. DS990 Model 1 Small Business System to handle the Workers' Compensation Claimant Index System, according to Bill Walker, claims manager at Liberty Mutual's Dallas and Houston offices.

Based on TI's TMS 9900 microprocessor, the DS990 Model 1 computer incorporates a 1,920-char. video display, 64K bytes of random-access memory with parity, and an optional 30-char./sec internal thermal printer. Mass storage is provided by two- or four double-sided, double-density diskette drives in a separate tabletop chassis. Maximum diskette storage on the Model 1 is 4.6M bytes.

Application software for claimant indexing was developed in TI's Terminal Programming Language (TPL) by Liberty Mutual programmers. TPL software consists of two parts: forms and procedures.

TPL Forms is used for drawing VDT-oriented data entry forms with field-editing specifications determined through operator-prompting menus. TPL Procedures is an English-like processing language supported by an interactive text editor, program compiler, and object module linker.

The Model 1 also supports SBC Basic, TX5 Basic, DX5 Cobol execution, TX5 Fortran, 990 Assembly Language and Pascal execution.

Liberty Mutual clerks now identify which claim a piece of mail is related to through the claimant index system on the computer. The clerk simply keys in the name of the claimant: The computer automatically lists the claimant's name, policyholder's name and address, date of injury, file number of the claim file and code number for the supervisor handling the claim on the screen.

Multiple Claimants

If there is more than one claimant with the same name, the computer lists information on all of them. By matching information from the correspondence (such as date of injury or location) with the information on the screen, the clerk can quickly determine which claimant (and, therefore, which claim) this piece of mail is related to.

If the claimant's name is not on the computer, the clerk knows that Liberty Mutual has not yet received the accident report from the employer. In that case, the clerk holds the piece of mail and tries again in a few days. In the past, trying to match a piece of mail to

(Continued on Page 116)

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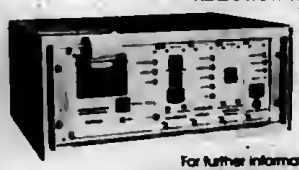

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Mini Bits

Management System Designed to Aid Doctors

PHOENIX — Computer Information Systems, Inc. is offering a practice management computer designed specifically for doctors.

The System 6000 is programmed to speed up receivables, control expenses, improve physician productivity and handle paperwork, the vendor claimed. It handles receivables aging reports, receivables patient status list, receivables day sheet and Blue Cross/Blue Shield insurance forms, a spokesman said.

The system costs $13,500. Computer Information Systems is at 850 N. Second Ave., Phoenix, Ariz. 85003.

Double-Density Minidisk Out for Microcomputers

MITCHELL, S.D. — A 5.25-in. double-sided, double-density flexible minidisk for microcomputers is available from Syncom. The product is part of the vendor's Ectype product line.

The disk was designed with a wear life of up to 10 million passes on both hard- and soft-sector products, the vendor claimed, adding the "human engineered" E-Z Vue box with its Tyvex envelope packaging ensures reduced abrasion and elimination static.

The disks cost between $4 and $7 depending on configuration, the vendor said from P.O. Box 130, Mitchell, S.D. 57301.

Callan Desktop Workstation Features Built-In Card Cage

WESTLAKE VILLAGE, Calif. — A desktop, integrated workstation including intelligent terminal and built-in card cage is available from Callan Data Systems.

The CD100's card cage is said to hold Intel Multibus or Digital Equipment Corp. LSI-11 Q-bus cards and the unit includes, as an option, two 5.25-in. mini-floppy disk drives.

Compatible CPUs include Intel Corp. 8080, 8085, Z80, 8086 and Z-8000. DEC's LSI-11 series permits a choice of the LSI-11/2 or the LSI-11/23. The unit costs $3,195 without floppy disks and $3,795 with two floppies from 2637 Townsgate Road, Westlake Village, Calif. 91361.

Floppy Disk Controller Bows For Teac FD-50 Disk Drives

MONTEBELLO, Calif. — Teac Corp. of America has unveiled a 5.25-in. floppy disk controller for use with its FD-50 series 5.25 floppy disk drives.

The FC-50 controller can be used with single- or double-sided drives and has the capability to read, write and format single- or double-density disks, the vendor claimed.

It costs $480, the vendor said from 7733 Telegraph Road, Montebellow, Calif. 90640.

Standby Power Systems Line Fit Micro, Mini Users

NECEDAH, Wis. — Best Energy Systems for Tomorrow, Inc. is offering a line of automatic standby power systems for microcomputer and minicomputer users.

The Best models include the B12-1000 SPS5, B12-1000 SPS 25, B24-1000 SPS 5, B24-1000 SPS 25, BR24-2500 SPS 5 and the BR24-2500 SPS 25. Features include crystal-controlled frequency 60Hz or 50Hz (± .002), modified sine wave-supressed third harmonics, quick plug-ins or an optional direct wire, the vendor said.

The power units cost between $1,785 and $2,635, the vendor said from P.O. Box 280, Necedah, Wis. 54646.

Irwin International Offers 'Micro-Winchester' Disk

ANN ARBOR, Mich. — Irwin International has announced the Model 510, a 5.25-in. "micro-Winchester" disk drive.

The 10M-byte disk drive, with an average access time of 25 msec, costs $2,500.

Irwin is at 2000 Green Road, Ann Arbor, Mich. 48105.

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For Small Businesses

Durango's Colt Desktop Available at Computer Store

BURLINGTON, Mass. — Durango Systems, Inc.'s Colt Desktop Computer System, with software available for small business users, is available at Computer Store, Inc. retail outlets.

An auxiliary dual disk drive may be added to the unit, which is a little larger than a typewriter, to increase diskette storage capacity to about 2 million characters.

Available applications software includes general ledger, accounts receivable, accounts payable, invoicing with inventory control and sales analysis, a spokesman said. A word processing package called Startext is also available.

The Colt Desktop

The basic unit including video screen, printer, keyboard, processor and file memory costs "just under $10,000," the spokesman said.

The Computer Store is located at Suite G-2, 50 Mall Road, Burlington, Mass. 01803.

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Insurer Speeds Claims Work

(Continued from Page 114)

a file that was not yet created involved weeks of fruitless labor. Paradoxically, this is one of the computer's easiest chores.

"Our new system is about 45% faster, and about 75% more accurate than the manual indexing system. It's one of the better improvements added in the 27 years I've been with the company. With this system, we can get through the day's mail in the same day," Walker said.

With an eye toward the future, Walker added, "Our small business system supports two disk drives which can house up to 16,000 files. Right now it houses only 8,000, and that leaves a lot of room for programming. We could save a lot of time in other operations with more programming."

Follow-up studies by the Liberty Mutual home office show that, in terms of man-hours alone, each DS990 Model 1 will pay for itself in less than a year, with cost savings of $13,000/year afterward. Since the first two Model 1s were installed last year, Liberty Mutual has implemented 11 more nationwide.

'... At Least They Could Have Asked Why You Brought That Along.'

Small Firm Goes On-Line, Integrates WP and DP, Finds Needed Flexibility

PROVIDENCE, R.I. — Larger companies may have the luxury of specialized DP systems, but smaller firms sometimes need the flexibility of one system incorporating both DP and word processing (WP) functions.

In trying to meet its needs, Raymond F. Murphy & Co. here decided not only to integrate its DP and WP functions, but also to convert its older batch system to an interactive one.

Raymond F. Murphy & Co. started using computers in the late 1960s when it established its own computer service bureau to handle client payrolls on a batch processing system. Later, it added internal job costing and accounts receivable applications and got a bigger system, but it was still a batch processing machine. Richard Volpe, controller at Raymond F. Murphy & Co., recalled, "When I came on board in 1974, we used the computer about 12 hours a week. When we added more client services — general ledger, trial balances, and financial statements — we were using the computer 60 hours a week, and our clients, especially the smaller firms, still wanted more."

While evaluating DP systems, Volpe had seen a demonstration of the Wang Laboratories, Inc. VS, a multiuser, multiapplication, interactive computer. Wang was about to announce the capability that combined both WP and DP in a single VS computer — the Integrated Information System (IIS). At that time the firm had also been using a Wang WP 20 Word Processing System.

Volpe admitted having some initial doubts about the interactive DP aspect of the IIS approach: "I had been thinking 'batch' all along, and I needed to turn my thinking around to interactive computing for our back-office auditing operations."

R.F. Murphy installed the Integrated Information System in mid-1979. The configuration consists of a VS central processor with either 128K or 256K bytes of main memory, a 90M-byte disk drive, a 400 line/min upper- and lowercase line printer and six CRT terminals.

Direct Power Access

The interactive computer gives the auditor direct access to the power of the computer. With the batch processing system used previously at R.F. Murphy, the auditor developed trial balances and financial figures manually. Then his work was turned over to a DP specialist, who coded it off-line for input to the computer. Next, the coded data went to DP center, where it usually went through a trial or editing run to confirm that all the information was correct. Finally, the data was run, and the auditor saw some results.

In contrast, when the auditor works with the interactive Wang system, he does all his work at the computer terminal itself. He enters the account number and starts working. The computer immediately validates the figures as he enters them. A special package developed for clients in construction business also automatically posts each cost to a specific job, confirming that the job exists and that the cost is approved.

Instead of having to wait for a trial run to discover a mistake, he knows immediately if he has entered data incorrectly, used a wrong account category and so on — not two days later, when he is looking for his finished report. After he has finished his work, he simply presses a button, and finished statements are printed out. Finally, the auditor's figures can be transferred directly to WP to be incorporated into the formal documentation presented to the client.

The whole job, from rough figures to final statement, can be done by the auditor without the services of expensive DP specialists to code data and run the computer. Eliminating these intermediate steps means a major savings in overhead and a big jump in the auditor's productivity.

If Richard Volpe was not sure about interactive computing, he had no such doubts about Wang word processing when he chose the Integrated Information System.

With the introduction of the company's first word processing system Wang's WP 20, typing productivity soared. The improvement was not difficult to measure: Over the next two years, until the WP 20 was replaced by the IIS, R.F. Murphy's auditing staff grew 60%; yet the typing load was carried by the same two people.

As a programmer himself, Volpe is especially pleased with the File Maintenance and Report Generation capabilities of the Wang system. "Using the Wang, I can develop a basic file maintenance routine in a half hour, vs. five or six hours on other systems I've worked with. The Report Generation utilities that come with the Wang help design a report quickly; then the word processing system makes it look pretty," he said.

The Integrated Information System also gives R.F. Murphy greater flexibility in utilization of manpower. Because CRT terminals are relatively inexpensive compared to people, the firm's philosophy is to let everyone do everything, to avoid specializing. Of its six CRT terminals, four can be used for both WP and DP.

Portable Power System Geared to Small User

ST. PETER, Minn. — A portable power system for use in the event of a power loss has been announced by GTO Electronics.

The Pacs-300A and Pacs-300B supply 110V ac power for emergency use to customers using small computers and word processing systems among other applications. The 300B also supplies ac power to remote locations.

Both units provide 150W continuous/300W surge power, have self-contained batteries and a solid-state LED battery indicator.

Both models sell for less than $400. More information is available from Clifford A. Swenson, GTO Electronics, 430 Ritt St., St. Peter, Minn. 56082.

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Computerworld Extra! is an extra issue of Computerworld — the second we have done — to be published this March 18th. It will appear in what our Editor, Drake Lundell, calls a "tabloid-zine" format. This means glossy, full-color covers on the outside, and a magazine format inside (printed on super calendared newsprint) — and tabloid-size throughout.

This issue of *Computerworld Extra!* will focus its entire editorial content on a single subject: "Communications Systems in the 80's." Top experts from all areas of the communications field will write magazine-length articles on a variety of topics including: Integrating Voice and Data Networks, The State of Videotex in the US, UK, France, and Canada; Network Management, Satellite Technology in the 80's, The Past and Future of the Communications Act and Federal regulations, Network Standards and Protocols, and Future Directions in Telecommunications Technologies. Plus, there'll be Wrap-up and Analysis articles for Data Communications Software, Data Terminal Equipment, and Data Communications Equipment.

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Data Comm Terminals-Dumb	44	26,000	25	61,000
Data Comm Terminals-Smart	34	22,000	33	81,000
Multiplexers	30	19,200	29	73,000
Distributed Processing Equipment	28	47,900	18	45,000
Computer Services and Timesharing	26	16,600	20	50,000
Telephones	26	16,600	14	38,000
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In Medicare Claims Work

GAO Confirms EDSF Contract Violations

By Marcia Blumenthal
CW Staff

WASHINGTON, D.C. — The U.S. Government Accounting Office (GAO) has generally substantiated allegations that Electronic Data Systems Federal Corp. (EDSF) violated its contract with the Health Care Financing Administration (HCFA) in order to bring its Medicare claims processing backlog within acceptable limits.

The GAO report, made public Dec. 16, was the result of a probe initiated last year by Rep. Paul Simon (D-Ill.) [CW, Nov. 19, 1979].

Specifically, the GAO found EDSF, a subsidiary of Electronic Data Systems Corp., removed possibly as many as 100,000 unprocessed claims from its mailroom in order to reach a goal of 150,000 claims outstanding by the end of 1979. EDSF said it had 173,000 claims outstanding at year end, but the GAO found the firm had between 248,000 and 268,000 such claims.

The Health Care Finance Administration contract imposes penalties on the Medicare contractor in 12 categories, some of which are related to work load. EDSF had only met one work load standard through September of this year. To date, EDSF has been assessed $1.1 million in contract penalties.

EDSF also allowed its coding employees to use an override feature if the data being entered into the system would normally have been rejected through built-in controls or editing features, the report noted.

Although not violations of the contract but more in the realm of questionable operations, EDSF also sent thousands of claims out of the state of Illinois for processing without notifying HCFA and destroyed correspondence from claimants. This correspondence was generally related to inquiries on the status of claims or disputes about the award.

EDSF's contract to process Medicare claims for Illinois is an experimental one, paying the contractor on a fixed fee rather than a cost basis, a GAO official said. Moreover, the contract is the first EDSF has had to both process Medicare claims as well as operate the DP facility. Generally, EDSF has operated the DP facilities for other contractors processing Medicare claims.

The five-year experimental contract will pay EDSF $41.8 million for administrative costs. However, that is only 3% of the cost of the total operation. The remaining 97% is related to claims paid out, the GAO official said.

The contractor responsible for processing claims determines the amount of money paid to the claimant. If the formulas and data for reimbursement are not accurate, the government stands to lose a lot of money, he said.

High Error Rate

EDSF's error rate on claims payout until recently has been more than two times the national average, the official noted. The average national error rate on claims payout is between 2% and 2.5% of every $100 in claims. EDSF had an error rate of 3.6% to 8.1% from the quarters ending June 1979 to September 1980, the official reported.

One reason offered for EDSF's poor performance is that it is the firm's first contract for both processing and DP operations and the company is on a learning curve.

In addition to pointing out deficiencies in error rate and work load operations, the GAO report also faulted EDSF for its fair-hearing procedures.

The hearings officers for most Medicare contractors are attorneys. Although EDSF group of nine hearing officers are headed by an attorney, the remainder of the group are not attorneys, and only three have college degrees, HCFA found.

Despite the irregularities in EDSF's performance, HCFA has taken no action to suspend or alter the contract, but said it will monitor EDSF more closely.

The GAO has criticized the HCFA for its contract monitoring policies, noting that EDSF, under a work load crises, had to deviate from its normal operating procedures.

Responding to the report, EDS, the parent corporation, said the GAO report found that the company had done nothing deceptive or illegal. He added that EDSF was taking steps to correct procedures necessary to improve its performance.

IBM Continues Dip In Revenue Market Share

GREENWICH, Conn. — IBM continued to lose revenue market share last year, dropping to 40.1% in 1979 from 43.2% in 1978, according to a recently published report on the top 100 DP companies by the Gartner Group here.

The Gartner Group developed its report on the top 100 industry firms from analyses of information contained in the firm's data base. Other significant observations showed that the top 100 firms, with total DP revenues of $45.7 billion, grew at 15.8% from 1978 to 1979. The top 25 firms garnered 84.7% of total DP revenues for the companies included in the report. IBM's absolute share of the top 100 DP revenues was only 31.6%, the report noted.

Mainframe companies still comprise the largest sector, claiming 65% of the revenues of the top 100 companies, although during the 1978 to 1979 period the share of the revenue pie for these companies decreased 3.6%. Minicomputer manufacturers were the next largest sector with 13% of the total revenue of the top 100 firms, the Gartner Group reported.

Severe Margin Pressure

On the whole the computer industry was under severe margin pressure during 1979, with 32 of the firms reporting lower margins and 19 reporting lower earnings. Earnings for the 54 firms whose revenues are predominantly from computer products grew at less than 2% for that time period.

Despite these hardships, minicomputer firms had a strong year in 1979. This group reported an average 30.8% growth in revenues, 27.9% growth in earnings, 34.7% growth in research and development, 30.2% in capital expenditures and a 25.5% increase in employment.

For the industry as a whole, growth in R&D was 18% for the reporting period, although without IBM the rate was a remarkable 31%, the report observed.

Capital expenditure increased in 1979 by almost 30% to $2.9 billion, led by IBM's capital commitment growth of 34.6%.

Other tidbits included in the report revealed that there were 30 software and service firms in the top 100 companies, more than any other segment of the industry. The cutoff point for inclusion in the ratings was $30 million.

The report is part of the Gartner Group's regular client services, but can be obtained separately from the firm at 545 Steamboat Road, Greenwich, Conn. 16830.

TI Cuts Work Schedules, Cites Softening of Demand

DALLAS — A softening of demand for computer products and a temporary overcapacity in the computer memory chip business has prompted Texas Instruments, Inc. to reduce work schedules for about 17% of its 90,000 world wide work force beginning in January.

Expected to last at least through the first quarter of 1981, a spokesman for TI said the cuts will be in the form of a lesser number of work hour/week.

The primary areas of its business that will be effected by the reduced work hours will be semiconductor operations and consumer-related product areas. Other areas, such as digital systems and government electronics, will maintain regular work schedules.

Economic Uncertainties

The company noted that the economic outlook for 1981 contains many uncertainties which they feel may limit industry growth in the near future, although its long-range goals have not changed, and full work schedules will resume as soon as business conditions permit.

In November, TI ordered many of its employees to take their vacation days around the holidays attributing the action to "market weaknesses" for some products.

A slump in the ordering of semiconductor stocks has some analysts agreeing with TI's perception. November order-rates showed a substantial decline in the rate of new orders.

Although TI realistically reflects the industry, a New York economic forecaster, Benjamin M. Rosen, noted that among U.S. suppliers, TI has the largest percentage of its business going to Europe.

Managers Buy Computeristics

HAMDEN, Conn. — Computeristics, Inc. has been sold to the company's management by the parent corporation, Uniroyal Corp.

The firm develops accounts receivable, payable, general ledger and other packages for both mini and mainframe systems. In addition, the company is a vendor of Data General Corp. systems and provides consulting in micrographics. Sales for 1979 were about $6 million.

The owner/management team will continue to function as it presently does with James Chambers as president; Rolf Diegel, vice-president of marketing; Russell Tisdale, vice-president of finance; Richard Van Saun, vice-president of production; and Chet Habegger, vice-president of administration.

All current development programs will continue on schedule, including a new data base-oriented accounts receivable system slated for a spring announcement.

The company will be headquartered in Hamden.

Based on Demand for Minis

Ontrax Betting on Snug Niche for Disk Systems

By Marcia Blumenthal
CW Staff

SUNNYVALE, Calif. — Although entry into the disk drive market is a risky and expensive proposition today, Ontrax Corp. here is betting the heady demand for powerful mini systems will create a snug niche for high-performance mini disk systems.

Although Ontrax was officially formed about one and a half years ago, the company's founders have been developing a powerful 8-in. Winchester disk drive for the past two years, according to Jim Snow, vice-president of marketing. Now emerging from the engineering stage, the firm has 40 employees gathered from all corners of the disk drive world.

The company was financed by initial venture capital of about $1.5 million from four venture firms. Second-round funding will bring in an estimated additional $3 million, Snow said.

Ontrax's recently unveiled Mini Wini (story on Page 113) packs up to 136M bytes of storage, which Snow claimed is about 62% more capacity than Fujitsu Ltd.'s 84M-byte 8-in. drive — the largest now available.

Three-Part Market

As Snow sees it, the mini disk drive market is settling into three segments. The low end is typified by the highly successful Shugart Associates. The mid-range group of companies produces 8-in. Winchesters in the 40M-byte to 60M-byte range and 14-in. Winchesters in the 160M-byte range.

Although many companies debate the possibilities of the high-end market, to date Fujitsu and Control Data Corp., and now Ontrax, have made serious forays into this segment, Snow maintained.

However, Ontrax doesn't intend to confine itself to 8-in. disk systems. Within the next six to nini months the firm will introduce a 14-in. Winchester disk drive in the 550M-byte storage range, Snow said.

Although initially selling to the OEM market, Ontrax intends to pursue the more risky end-user market for its product — a strategy usually avoided by most mini disk drive makers.

Controller's 16 Cards

One reason the firm is opting for the end-user route is the controller developed for the disk product. While the controller for the current disk product uses four boards, Ontrax' controller has space for 16 cards. This design will allow a user to configure the controller as a CPU system that can be adapted for a variety of functions, Snow emphasized.

In designing its product, Ontrax developed and patented a head position actuator that requires no magnets. Ontrax uses two of these actuators in its 8-in. disk drive which, while not unusual in larger disk products, is unique to lower cost disk systems, Snow said. Moreover, the product can be adapted for use with thin-film technology, Snow said.

Although the firm is planning to sell its disk products to the end-user market, it has not yet set an end-user price, Snow noted.

On an OEM basis, in quantities of 250 to 500 units, the drive sells for $4,000 each and the basic controller costs $1,500.

Despite the power of an 8-in. Winchester system, its pricing is critical, Snow explained. With multiprocessing chips, such as Motorola, Inc.'s M68000, allowing a lot of power to be packed on a system for a low price, powerful peripherals must be priced relative to the processing unit, Snow noted.

The firm intends to set its end-user price for the 8-in. Winchester disk drive during the first part of 1981.

Aside from pricing, the major hurdle to serving the end-user marketplace will be establishing a sales and service organization.

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To find out more about the new IPL 4400 family, call your local IPL representative. Or call or write: Vice President, Sales, IPL Systems, Inc. 360 Second Avenue, Waltham, Massachusetts 02154. (617) 890-6620.

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Memorex Forms Sales Group

CUPERTINO, Calif. — Memorex Corp.'s Communications Group announced the formation of a sales force responsible for selling its communications products and appointed five regional sales managers to head this effort.

Memorex Communications Group products include the 1300 screen printer, 1377 and 2078 display stations, 2076 remote cluster controller, 1371/1372 terminal controllers, 2089 line printer, 1270 terminal control unit, 1380 communications processor and specialized software.

The five communications regional sales managers are Johnnie Holt, Western region; Ron Bulin, Central; Steve Foley, Southern; Joe Ryan, Eastern; and Jim Peck, Southwestern.

They will head a staff of sales representatives working out of Memorex offices in major cities across the U.S. Memorex International will continue to sell and service Memorex Communications products outside the U.S., a spokesman said.

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CW-15

Burroughs, Univac Win Air Force Contracts

SCOTT AIR FORCE BASE, Ill. — The U.S. Air Force recently awarded contracts to Burroughs Corp. and Sperry Univac with a total first-year value of $66 million to develop systems for its Phase IV program.

Started in 1976, the much talked-about Phase IV program will significantly reduce the number of base-level computer systems and save more than 250 positions in the DP work force, the Air Force said.

The program will also result in the establishment of 14 regional DP centers, each serving two or more Air Force installations.

The contracts have a short-term value of $38.5 million to Sperry Univac and $27.5 million to Burroughs.

For the next 26 months, each contractor will compete independently to convert the Air Force's existing Univac and Burroughs applications programs to operate on modern computer equipment, the transition of existing computer programs to operate on the new equipment, and result

Orders & Installations

computer systems from their current product line. After each contractor has demonstrated operation of the transitioned programs on their equipment to meet base-level DP needs, one contractor will be selected in early 1983 to provide more than 150 modern computer systems for the Air Force.

Unique Concept

The contract implements a unique computer system acquisition concept. It will provide for the acquisition of new

in the delivery of an integrated, ready-to-operate base-level computer system.

Ultimately, the new computer system will be installed at 115 Air Force installations around the world to meet individual base-level DP requirements, a spokesman said.

After Phase IV computer systems are installed, they will allow commanders and managers to more efficiently employ and support complex weapons systems such as the F-15 and F-16 tactical fighters. These computers will support essential weapons systems maintenance and supply activities and permit more effective management of personnel, financial, engineering and equipment resources throughout the Air Force.

Overdue Replacement

Colonel Dale Sonstrom, Phase IV program manager, summarized the program as "a long overdue replacement of two expensive to operate and out-of-date computer systems.

"When it becomes fully operational in 1985, Phase IV will provide the Air Force with an integrated base-level DP capability to meet user needs into the 1990s and provide the potential for expansion of individual Phase IV computers to accommodate additional requirements through the remainder of this century," he said.

Other Awards

Informatics, Inc. has been awarded a two-year $600,000 contract from the U.S. Air Force's Rome Air Development Center. The terms of the agreement call for Informatics' support of the Air Force Intelligence Service's Common Users' Baseline for the Intelligence Community program (Cubic).

Interaction Systems, Inc. has received an order for 1,000 of its Model TT-100 touch-sensitive CRT terminals from CL Systems, Inc. The order is valued at between $2 million and $3 million.

MAP Array Processors, products of CSPI, Inc., have been ordered by the Ford Motor Co. for production-line engine test stations.

The National League of Cities has purchased a Local Government Financial System (LGFS), including a Digital Equipment Corp. PDP-11 minicomputer, from American Mangement Systems, Inc.

Nickels & Dimes

Digital Equipment Corp. plans to call for the redemption of its 8-7/8% convertible subordinate debentures due in 2005 in the near future, subject to market conditions.

$$$

Tandem Computers, Inc. intends to file a registration statement with the Securities and Exchange Commission with respect to 1.2 million shares of its common stock.

$$$

Comsat General Corp. plans to purchase a total of approximately 35,700 shares of Comsat common stock, for a proposed acquisition costing roughly $1.5 million.

$$$

Prime Computer, Inc.'s board of directors have approved a three-for-two stock split, effective in the form of a 50% stock dividend. These additional shares will be distributed Dec. 19 to stockholders of record Dec. 1.

$$$

Teadata Systems Corp. has reported it gained a profit exceeding $1 million on an investment transaction. The after-tax profit, equal to approximately 60 cents per share, will be formally announced in 1980.

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Distributor Awarded Nearly $600,000

Adds Loses Suit Charging Unfair Competition

By Jeffry Beeler
CW West Coast Bureau

OAKLAND, Calif. — A former distributor of Applied Digital Data Systems, Inc. (Adds) CRT terminals has been awarded damages totaling nearly $600,000 in a lawsuit charging Adds with knowingly supplying defective products and unfairly competing with that distributor for a key sales order.

The suit — which was filed about two years ago by Consolidated Data Terminals, Inc. (CDT) — was decided Dec. 2 when a U.S. District Court judge here ruled that Adds knew about but failed to correct long-standing flaws in its Regent 100 and 200 CRT terminals.

The court also found that the terminals were "fraudulently represented [to CDT] as inherently reliable" even though they were "negligently designed" and routinely failed to meet performance specifications.

Intel Bid

In addition, the court concluded that Adds had "wrongfully interfered" with CDT's efforts to close a June 1978 end-user sales deal with Intel Corp.

Although the court decision reaffirmed Adds' right to compete with its distributors for the same order, the judge questioned the defendant's bidding practices in the Intel deal.

The original round of bidding for that order was at standard end-user prices and ended with CDT submitting the lowest quote and thus apparently winning the competition.

But when Adds was informed of the results and learned it had been underbid by $45, it submitted a revised quote based on the discounts it usually reserves for OEMs.

That tactic enabled Adds to undercut CDT's original bid and eventually win the lucrative Intel order at its distributor's expense.

The court agreed with CDT's contention that Adds' bidding practices in the Intel affair constituted interference in the distributor's business dealings and awarded the plaintiff almost $29,000 as compensation for its lost sales.

In other damages, the court awarded CDT nearly $112,000 to compensate it for the 1978-1980 profits it lost as a result of Adds' defective equipment.

In addition, the court ordered Adds to pay the distributor an additional $15,000 in fraud-related damages and $500,000 in punitive damages for "knowingly disregarding CDT's rights and interests."

At the same time, however, the court accepted Adds' counterclaim demanding that CDT honor some $70,000 in back payments and interest dating from Dec. 1978.

Altogether, Adds' liabilities from the suit total more than $585,000. The Hauppauge, N.Y.-based terminal maker has already disclosed its intention to appeal the court's decision.

The outcome of the CDT vs. Adds case will serve as a warning to hardware vendors in general and might even persuade other injured Adds distributors to sue the company on their own, according to CDT attorney Richard Perez.

Filed in Dec. 1978, the suit charged Adds with supplying terminals that operated at only one-fourth of their advertised 19,200 bit/sec data rate.

In some deliveries to CDT, all the enclosed products were defective in some way, and as many as 25% were found to be "dead on arrival," the distributor contended.

The high defect rate in Adds' product shipments reportedly hindered CDT's sales efforts and ate into the distributor's profits by necessitating frequent service calls to its customers.

In the spring of 1978, CDT severed its ties to Adds and turned to Lear Siegler, Inc. as its primary terminal supplier.

CDT's suit also accused Adds of consistently failing to furnish the distributor with sales leads, but the court rejected the plaintiff's complaint.

"Adds' failure to provide leads affected CDT's ability to sell Adds' products, but this failure did not constitute material breach of contract," the court said.

Contracts

Computer Sciences Corp. has received a $10 million contract from Pan American World Services, Inc., for technical services at the U.S. Air Force's Arnold Engineering Development Center in Tullahoma, Tenn.

Codex Corp. has announced the renewal of its contract with the Department of Defense Commercial Communications Office for the Channel Packing Program that Codex designed and installed.

The U.S. Defense Mapping Agency has signed a contract with Gerber Scientific Instrument Co. The agreement, which is approximated at $1 million, is for an undisclosed number of Gerber 4477P color cartographic drafting systems.

Boeing Computer Services Co. has won a contract valued at $6,400,000 from the General Services Administration to support the U.S. Army Request/Retrain program.

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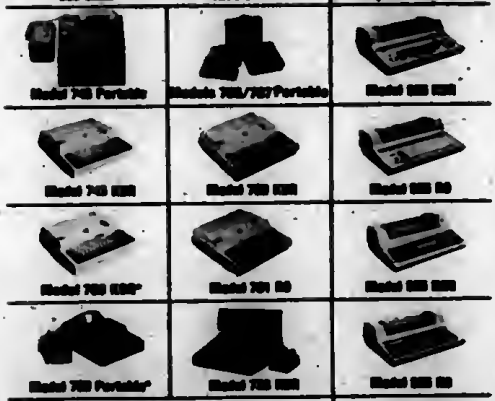

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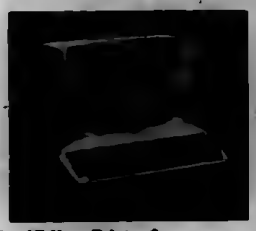

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Supershorts

Data General Corp. has begun making customer shipments of its AOS/VS software for the 32-bit Eclipse MV/8000 three months earlier than scheduled. The software was released early "because of the very positive feedback we have received from our five test sites," a DG spokesman said.

– – –

Erwin Tomash, founder of Dataproducts Corp., received the Outstanding Achievement Award from the University of Minnesota.

W. Michael Blumenthal, vice-chairman and chief executive of Burroughs Corp., announced that the company will endow a new fellowship at New York University's Graduate School of Business Administration as one of its regularly scheduled contributions to educational institutions.

– – –

Beehive International has finalized an agreement with the Irish Industrial Development Authority to construct a manufacturing plant in Fermoy, County Cork, Ireland.

– – –

Charge Card Association, which serves Visa and Master Card accounts throughout the Midwest, has installed the Genasys International, Inc.'s automated application system development software package for design, coding and documentation purposes.

– – –

Lee Data Corp. has authorized Genesis Marketing Group, Inc. to sell Lee's Series 300, IBM-compatible distributed systems, in a recent agreement.

– – –

American Management Systems, Inc., a computer systems, services and management consulting firm, has been named an authorized Digital Computer Distributor by Digital Equipment Corp.

– – –

Canadian General Electric, Data Communications Products Division, has entered an agreement with C. Itoh Electronics, Inc., for exclusive sales and service rights to C. Itoh's full line of computer peripherals in Canada.

– – –

RCA Service Co. said it now provides contract service on over 40,000 data communications terminals throughout the U.S.

– – –

Prime Computer, Inc. recently opened a regional customer education center in Oak Brook, Ill. to serve that 21-state area.

– – –

Donald R. Herriott, head of the Lithographic Systems Development Department of Bell Labs in Murray Hill, N.J., is the recipient of the Institute of Electrical and Electronics Engineers (IEEE) 1981 Cledo Brunetti Award.

– – –

Shugart Associates has reorganized its direct sales efforts into four geographic regions.

New Companies

Power Data Systems, Inc. has been established to market and sell hardware and software to the electronic information processing industry, specializing in communications, networking and multitasking systems. Its headquarters are at 160 New Boston St., Woburn, Mass. 01801.

Creative Management Concepts, Inc. was incorporated to provide management consulting services to small and medium-sized businesses, specializing in information processing management and business information systems. They are located at 836 Taylor Ave., Kirkwood, Mo. 63122.

Kislowski & Co. has been formed to provide consulting services in systems, communications and computer operations for the retail and distribution industries. It is located at Suite 217, 1100 Quail St., Newport Beach, Calif. 92660.

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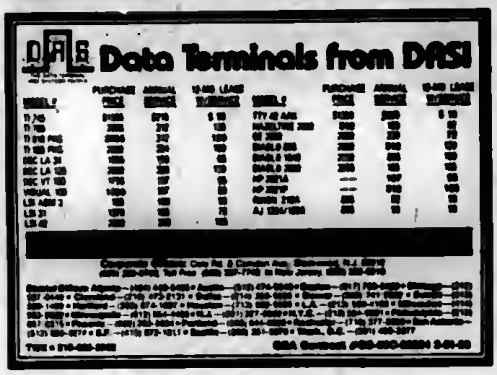

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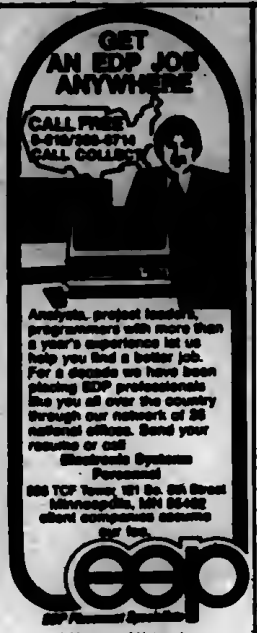

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Develop, organize, schedule and direct software engineering activities from requirements definition through implementation and testing. Perform computer hardware selection trade-offs and hardware/software design trade-offs.

SCIENTIFIC PROGRAMMERS AND ANALYSTS
Perform programming and programmer/analyst functions on a VAX 11-780 system in support of special engineering applications. Experience on PDP-11 systems a plus.

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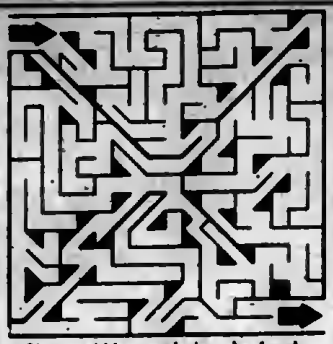

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FLORIDA
MVS Systems Software Supervisor

Large IBM 3033 MVS installation requires individual with strong technical background in MVS Operating Systems Software to assume leadership role in software area. BS Degree and three years experience in systems software or equivalent combination. Minimum salary $25K+ — negotiable. Resume and salary history to Director, Central Florida Regional Data Center, University of South Florida, Tampa, FL 33620. Application deadline: Jan. 16, 1981

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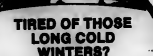

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ANALYST/PROGRAMMER — To $28M
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FLORIDA
MVS Tech Support Manager

Large IBM 3033 MVS shop requires individual with strong DP management and technical systems and communications software and hardware background, to assume overall management and leadership responsibilities. Minimum BS Degree. Salary $27K+ — negotiable. Resume and salary history to Director, Central Florida Regional Data Center, University of South Florida, Tampa, FL [illegible]. Application deadline Jan. 16, 1981.

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COMPUTER SCIENCE: School of Natural Science and Math. Permanent position, beginning September, 1981. Instructor/Assistant Professor/Associate Professor rank, based on experience and academic credentials. Teaching and/or data processing experience desired. [illegible] Teaching 12 credits per semester of undergraduate Computer Science, beginning through upper level, in an applied Computer Science program. Background in FORTRAN, COBOL, and a block structured language useful, with some specialized experience desired. Assist in curriculum development, as related to various computer systems, micro through main. Advise students, serve on faculty committees, participate in academic and professional activities. Application deadline: February [illegible], 1981. Send application to: Dr. Gerald [illegible], Chairperson Search Committee, [illegible] Hall, Indiana University of Pennsylvania, Indiana, PA 15705. IUP is an Affirmative Action, Equal Opportunity Employer offering excellent fringe benefits.

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Computer Science Department
The University of Alabama in Huntsville
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P.O. Box [illegible]
Wichita, Ks [illegible]

E.O.E. M/F/H

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The Manager of Computer Operations must have a B.S. Degree in Electrical Engineering, Computer Science, or a related [illegible]

The Manager will be responsible for the day to day operation of a DEC System 10 computer facility, and supervise several people including programmers and operators.

The position is [illegible] [illegible] Salary range [illegible] depending upon the candidate's qualifications. In order to assure full consideration, applications must be received by Jan. 16, 1981. [illegible]

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Project Analyst I
Full Time

University of Iowa, Department of Family Practice. [illegible] FORTRAN, PL1, Prime 750 and IBM 370 operating system procedures and utilities (especially POWER+ and "WYLBUR"), and (3) experience in the use of BMDP, IDA, SAS, or SPSS in support of clinical research. [illegible] Salary: $14,[illegible] Send resume to William M. [illegible], Dept. of Family Practice, University of Iowa, [illegible], Iowa City, Iowa 52242.

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Applicants should have a Bachelor's degree or equivalent and five years experience on large scale computer operations. Will be responsible for computer operations utilizing a combination of local, batch and on-line remote terminal data entry and display systems. Hardware is an IBM 4331. Directly supervises all aspects of computer operations, including console operations, start-up procedures, tape and disc library procedures, and scheduling procedures in a multi-programming environment. Some programming knowledge required.

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Attn: Resident Recruiter

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Programmer Analyst with 2+ years RPG II and IBM System 34 experience. Will work in consulting environment and will participate in development of software packages. Send resume to:

Southwest Data Services, Inc.
P.O. Box 1540
Scottsdale, Arizona 85252
ATTN: Jim Wilcox

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EOE

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intel

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Sal: $1740 - $2125/Month

Requires AA degree, 3 years COBOL programming, one year of which must have been in an on-line environment with large scale computer oriented systems. Or college degree may substitute for one year of experience. Experience with HDR operating and/or Sperry-Univac equipment, preferred. Sperry-Univac equipment including Fortran, Pro and library systems, user documentation/definition, and technical writing desirable. 35% fringe benefit package. For details, application and supplemental data form contact Personnel Office, City of Newport Beach, 3300 Newport Blvd. Newport Beach, California 92663, phone: 714-644-3101. Submitted resumes. Open until sufficient applications are received.

EOE M/F

SYSTEMS PROGRAMMER

We are looking for a DOS/VSE/SP systems programmer to work in our small technical support group. The successful candidate for this position should have over three years service experience as a systems programmer in a DOS shop that includes a telecomm or a database environment.

We are currently using DOS/VSE, IDMS, VTAM, NCP (ver. 10) running using SDLC & BSC), TAM/MASTER, LIBRARIAN, LIBDL, LOCOL, etc. on two CPU's (4341 148) with shared DASD's and tape. We are contemplating migrating to VM and OS/MVS.

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WWP06	RWP06	300 MB DISK AND CONTROLLER	44000	23000
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WWM05	RWM05	300 MB DISK AND CONTROLLER	N/A	25000
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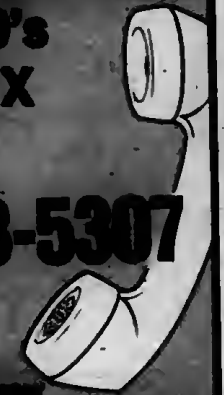

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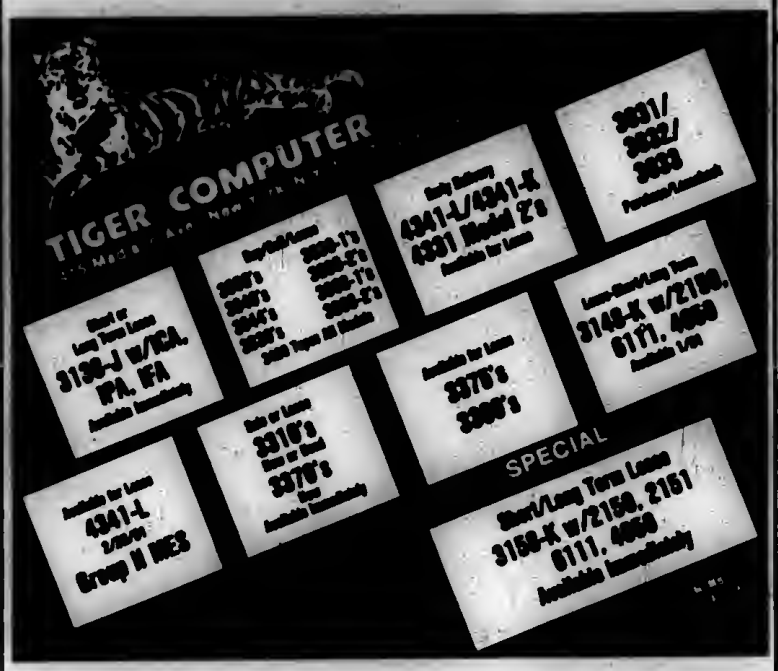

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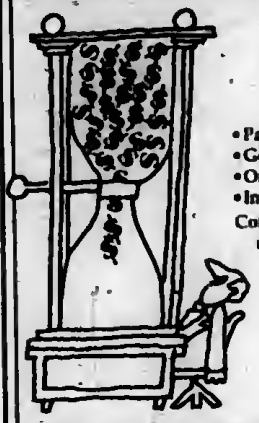

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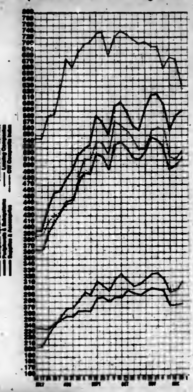

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Computerworld Stock Trading Summary

CLOSING PRICES TUESDAY, DECEMBER 23, 1980

All statistics compiled, computed and formatted by TRADE QUOTES, INC. Cambridge, Mass. 02139

EXCH		1979-80 RANGE (1)	CLOSE DEC 23 1980	WEEK NET CHNGE	WEEK PCT CHNGE
	COMPUTER SYSTEMS				
A	AMDAHL CORP	15- 42	34 7/8	+ 3/4	+2.1
N	BURROUGHS CORP	47- 88	52 3/8	+1 1/8	+2.1
O	COMPUTER AUTOMATION	9- 27	19	-2	-9.0
N	CONTROL DATA CORP	35- 77	72	+1 1/4	+1.7
O	CRAY RESEARCH INC	10- 31	33 3/8	+1 1/2	+4.6
N	DATA GENERAL CORP	46- 87	67 3/4	-1 3/4	-3.0
N	DATAPOINT CORP	44-110	111	+7 1/4	+6.9
N	DIGITAL EQUIPMENT	53- 98	91 1/8	+1	+1.1
N	ECCO INC.	6- 18	16 7/8	+1 3/4	+12.3
N	ELECTRONIC ASSOC.	6- 13	7 7/8	+ 1/8	+1.6
N	FOUR-PHASE SYSTEMS	20- 49	22 5/8	+ 1/2	+2.1
N	FOXBORO	31- 59	38 1/8	+2 3/8	+6.7
O	GENERAL AUTOMATION	7- 19	9 1/4	+1 1/8	+14.3
O	GRI COMPUTER CORP	1- 2	1 3/8	0	0.0
N	HEWLETT-PACKARD CO	44- 95	88 1/8	-3 1/8	-3.4
N	HONEYWELL INC	45-111	110 3/8	+3 3/8	+3.2
N	IBM	50- 79	67 1/4	+3	+3.0
O	MAGNUSON COMP SYSTS	20- 46	45	- 1/2	-1.0
N	MANAGEMENT ASSIST	9- 25	14	- 1/4	-1.7
O	MANUFACTURING DATA S	22- 38	72 1/2	+4 1/2	+6.6
O	MINI-COMPUTER SYST	2- 6	1 7/8	- 1/4	-11.7
O	MODULAR COMPUTER SYS	9- 21	24 1/2	+2 3/8	+10.7
N	NCR	52- 82	72	+5 1/2	+8.3
N	PRIME COMPUTER INC	10- 39	34 7/8	+1 1/4	+3.7
N	PERKIN-ELMER	26- 70	67 7/8	+9 7/8	+17.7
N	SPERRY CORP	42- 60	59 1/2	+3 5/8	+6.0
A	SYSTEMS ENG. LABS	11- 53	52 3/4	0	0.0
O	TANDEM COMPUTERS INC	15- 70	70	0	0.0
N	TEXAS INSTRUMENTS	79-138	117	-7 1/4	-5.8
A	WANG LABS.	17- 40	36 3/4	0	0.0
	LEASING COMPANIES				
O	BOTHNC FINANCIAL CP	13- 27	31 1/2	+1 1/2	+7.0
N	COMDISCO INC	6- 24	23 1/2	+1 7/8	+9.0
A	COMMERCE GROUP CORP	1- 2	3/8	- 3/8	-50.0
A	COMPUTER INVSTRS GRP	0- 4	1/4	- 3/8	-60.0
O	CONTINENTAL INFO SYS	3- 15	4 1/4	+ 1/8	+3.0
N	DATRONIC RENTAL	3- 8	4 3/8	+ 1/8	+2.7
A	DCL INC	3- 8	2 3/4	0	0.0
N	DPF INC	5- 13	6 1/8	+ 1/2	+8.0
O	ITEL	1- 15	7/8	0	0.0
O	LEASPAC CORP	1- 2	3/8	0	0.0
A	PIONEER TEX CORP	2- 4	3 7/8	- 1/4	-6.0
N	RELIANCE GROUP INC	24- 79	71 1/4	+ 1/2	+0.7
N	U.S. LEASING	12- 26	25 3/4	+1 1/4	+5.1
	SOFTWARE & EDP SERVICES				
O	ADVANCED COMP TECH	1- 6	6	- 1/4	-4.7
O	ADVANCED SYSTEMS INC	12- 15	12 1/2	+1	+8.0
O	ANACOMP INC	7- 24	21	+1 3/4	+7.0
O	ANALYSIS INTL CORP	3- 14	10	- 1/2	-4.7
A	APPLIED DATA RES.	6- 24	20 3/8	+1	+5.1
N	AUTOMATIC DATA PROC	21- 53	46 5/8	+ 7/8	+1.9
O	CBA COMPUTER ASSOC	9- 17	16 1/2	+2 1/4	+15.7
O	COMPUTER HORIZONS	1- 8	2 1/8	+ 1/8	+6.3
O	COMPUTER NETWORK	4- 8	6	- 1/8	-2.0
N	COMPUTER SCIENCES	11- 30	19 1/4	+1	+5.4
O	COMPUTER TASK GROUP	1- 22	20 1/2	+1 1/2	+7.9
O	COMPUTER USAGE	2- 10	7 1/4	+ 3/4	+11.5
O	COMPUT AUTO REP SVC	4- 11	7 7/8	-1 1/8	-12.5
O	COMSHARE	11- 21	16 1/2	+ 1/2	+3.1
O	CULLINANE DATABASE	18- 48	38 1/2	- 1/4	-0.6
O	DATA DIMENSIONS INC.	1- 6	1 1/4	0	0.0
O	DATATAB	1- 4	1 1/8	+ 1/8	+12.5
O	DBI CORP	4- 9	7 3/8	+ 1/2	+7.3
N	ELECTRONIC DATA SYST	19- 27	20 7/8	+ 3/8	+1.8
N	INFORMATICS INC	9- 25	23 7/8	+1 1/4	+5.0
O	INSYTE CORP	1- 2	1 3/4	- 1/4	-12.5
O	IPS COMPUTER MARKET.	1- 6	1 1/4	0	0.0
O	KEANE ASSOCIATES	3- 9	8 1/2	+ 1/4	+4.7
O	KEYDATA CORP	1- 8	7/8	-	-0.7
A	LOGICON	12- 30	26 1/8	+1 7/8	+7.6
O	MATHEMATICA INC	0- 18	14 3/4	+ 1/4	+1.7
O	MATHEMATICAL APP GRP	7- 23	17 1/2	0	0.0
O	NATIONAL DATA CORP	10- 23	21 3/4	+2 7/8	+9.9
N	PLANNING RESEARCH	0- 13	7 3/4	+ 1/8	+1.6
O	PROGRAMMING & SYS	1- 1	3/4	0	0.0
O	RAPIDATA INC	4- 10	8 7/8	+ 1/4	+3.0
O	REYNOLDS & REYNOLD	20- 24	20	- 1/4	-1.3
O	SYSC INC	6- 24	22 1/2	+ 1/2	+2.2
O	SCIENTIFIC COMPUTERS	6- 34	29 1/4	+1 1/4	+4.4
N	TYMSHARE INC	17- 44	41 1/4	+ 1/2	+1.2
A	URS CORP	5- 17	14 3/8	- 1/4	-1.7
N	WYLY CORP	4- 20	16 1/8	+1 3/8	+9.0
	PERIPHERALS & SUBSYSTEMS				
N	AM INTERNATIONAL	13- 24	14 3/8	+1 1/4	+9.0
N	AMPEX CORP	14- 36	34 5/8	+2 3/8	+6.3
A	ANDERSON JACOBSON	9- 25	22 1/2	+1 1/2	+7.1
O	AUTO-TROL TECHNOLOGY	10- 62	47	-1 1/2	-3.0
O	BEEHIVE INT'L	3- 29	28 1/2	+4 1/4	+17.0
A	BOLT,BERANEK & NEW	12- 37	36 7/8	+3 1/8	+9.3
N	BUNKER RAMO	17- 41	27 3/4	+2 2/8	+6.7
O	CAMBRIDGE MEMORIES	1- 9	8 1/8	- 1/8	-3.0
N	CENTRONICS DATA COMP	19- 35	21 1/2	-1 3/8	-6.0
A	CETEC CORP	2- 7	6 7/8	0	0.0
O	COMPUTER DEVICES INC	5- 10	7 3/4	+1 1/4	+19.2
O	COGNITRONICS	1- 10	9 1/2	+ 7/8	+10.1
O	COMPUTER COMMUN.	4- 10	2	+ 1/4	+14.2
O	COMPUTER CONSOLES	4- 29	23 3/4	+ 1/2	+2.1
O	COMPUTER TRANSCEIVER	1- 6	4 5/8	+ 1/2	+12.1
N	COMPUTERVISION CORP	24- 92	77	+1	+11.3
N	CONRAC CORP	13- 25	17 5/8	+1 1/8	+6.7
N	DATA ACCESS SYSTEMS	6- 22	22 1/2	+ 1/2	+2.2
A	DATAPRODUCTS CORP	11- 30	25 3/8	+2 1/2	+7.0
O	DATUM INC	2- 8	2 3/8	- 1/8	-5.0
O	DECISION DATA COMPUT	2- 6	4 7/8	0	0.0
O	DELTA DATA SYSTEMS	1- 3	1 1/2	- 1/8	-7.6
O	DATARAM CORP	6- 37	11 1/2	- 1/2	-4.1
N	ELECTRONIC M & M	3- 9	7 1/2	0	0.0
O	EVANS & SUTHERLAND	21- 83	64 1/2	-2 1/2	-3.1
O	FABRI-TEK	1- 4	3 3/8	+ 1/8	+5.0
O	GENERAL COMPUTER SYS	1- 7	7	+1 3/8	+24.4
O	GEN'L DATA COMM IND	8- 22	17 1/4	- 1/2	-2.8
O	GENERAL TERMINAL CP	1- 4	1 1/4	-	-4.5
N	HAZELTINE CORP	12- 33	27 3/8	+2 3/4	+10.0
N	HARRIS CORP	25- 55	54	+4 1/2	+9.0
O	INFORMATION INTL INC	8- 10	10 1/4	+ 1/4	+2.0
O	INTEL CORP	22- 50	39 1/4	-1 1/2	-2.6
O	INTERSIL	13- 34	23 3/4	- 1/8	-0.5
A	LUNDY ELECTRONICS	4- 17	12 1/8	- 1/4	-2.0
O	MSI DATA CORP	0- 16	12 1/2	+ 5/8	+5.3
N	MEMOREX	10- 24	13 7/8	+ 1/2	+4.0
O	MOHAWK DATA SCI	10- 21	24 1/8	+ 3/8	+1.6
O	ONEX	3- 12	11	0	0.0
N	PARADYNE CORP	9- 34	24	+3 3/4	+20.2
A	PERTEC CORP	9- 30	12 3/8	+1 3/4	+5.7
O	RAMTEK CORP	10- 22	21 1/4	+ 1/4	+1.1
O	RECOGNITION EQUIP	5- 31	16 3/4	+ 1/2	+3.0
O	SCAN DATA	1- 8	1 5/8	+ 1/4	+18.1
N	STORAGE TECHNOLOGY	12- 26	22 1/2	+ 3/8	+2.0
O	SYKES DATATRONICS	14- 58	36 1/2	+3 3/4	+11.4
O	T BAR INC	14- 24	21 1/4	+ 1/4	+1.1
A	TEC INC	5- 9	4 1/4	0	0.0
N	TEKTRONIX INC	42- 70	62 1/4	+7 1/4	+13.7
N	TELEX	3- 8	6 1/8	+ 5/8	+7.0
O	TESDATA SYSTEMS CP	8- 26	13 1/2	+ 7/8	+6.9
A	TIMEPLEX INC	7- 33	29 3/8	+ 1/8	+0.4
O	WILTEK INC	1- 3	2 7/8	+ 1/2	+21.0
	SUPPLIES & ACCESSORIES				
A	AMERICAN BUS PRODS	8- 18	14 3/8	+ 1/4	+1.7
O	BALTIMORE BUS FORMS	1- 2	1/2	0	0.0
O	BARRY WRIGHT	8- 22	20 3/8	+ 1/8	+0.6
O	CYBERMATICS INC	1- 2	7/8	0	0.0
A	DUPLEX PRODUCTS INC	11- 16	13	+ 1/4	+1.9
N	ENNIS BUS. FORMS	12- 21	16	- 3/8	-2.4
N	3M COMPANY	46- 63	56 1/2	+1 1/8	+2.0
O	MOORE CORP LTD	27- 37	34 1/4	+1 3/4	+5.3
N	NASHUA CORP	20- 35	24 1/4	+1 1/8	+4.8
O	STANDARD REGISTER	27- 33	21 1/4	+ 1/2	+1.4
N	TAB PRODUCTS CO	9- 30	22 1/8	- 7/8	-3.8
N	WABASH MAGNETICS	11- 81	30 1/4	- 3/4	-0.0
N	WALLACE BUS FORMS	13- 26	22 3/8	+ 3/4	+3.4

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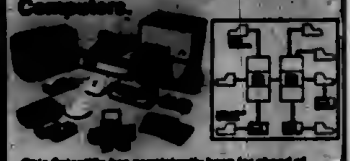

Ohio Scientific has consistently been far ahead of the competition. Most features now taken for granted were first delivered by Ohio Scientific, such as Full Floating Point BASIC in Microsoft ROM in personal computers and Winchester disk-based small business computers. We are the only company offering total home monitoring and control, and the only company offering distributed microcomputing for the small office of the future.

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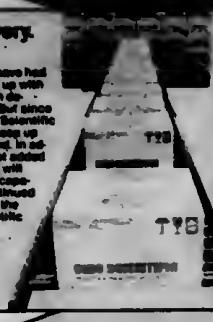

Quite frankly, we have had problems keeping up with the rapid growth in demand in the past. But since July of 1978, Ohio Scientific has been able to keep up with dealer demand. In addition, we have just added a new plant which will nearly double our capacity to ensure continued good deliveries in the future. Ohio Scientific products are also backed by several regional stocking distributors.

Ohio Scientific: The leader in computer retailing.

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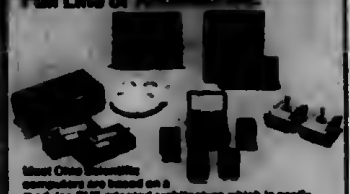

Most Ohio Scientific computers are based on a modular, BUS-oriented architecture which is easily expanded by simply plugging boards in.

Ohio Scientific accessories range from plug-in analog data acquisition systems for process control and laboratory applications to joysticks for computer games. We offer our dealers the accessories for every market that the computer retailer should address.

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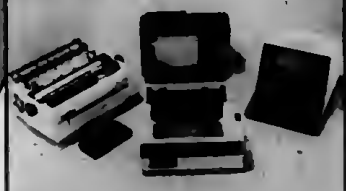
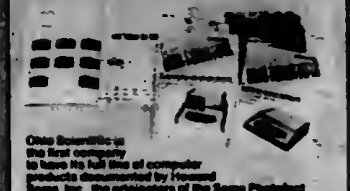
Peripherals.



Ohio Scientific has carefully selected the cream of the crop of computer peripherals from the industry leaders, private-labels them, and offers them to dealers at prices typically better than the direct 100-piece price.

Support and Documentation.



Ohio Scientific is the first company to have its full line of computer products documented by Howard Sams, Inc., the originators of the Sams Photofact series of consumer electronics service documentation. Ohio Scientific offers factory training in sales, software support and field service. Certain courses are now required for some classifications of dealerships.

For more information concerning computer retailing in the 80's, send the attached form along with your business card to:

National Sales Manager
Ohio Scientific, Inc.
1333 S. Chillicothe Road/Aurora, Ohio 44202
(216) 831-5600

Please include a sample of any advertising literature your firm may have developed

YES! I would like more information about retailing

OHIO SCIENTIFIC COMPUTERS

Name_____ Title_____
Company_____
Street_____
City_____ State_____ Zip_____
Phone_____ Years in business_____
Principal product/service_____